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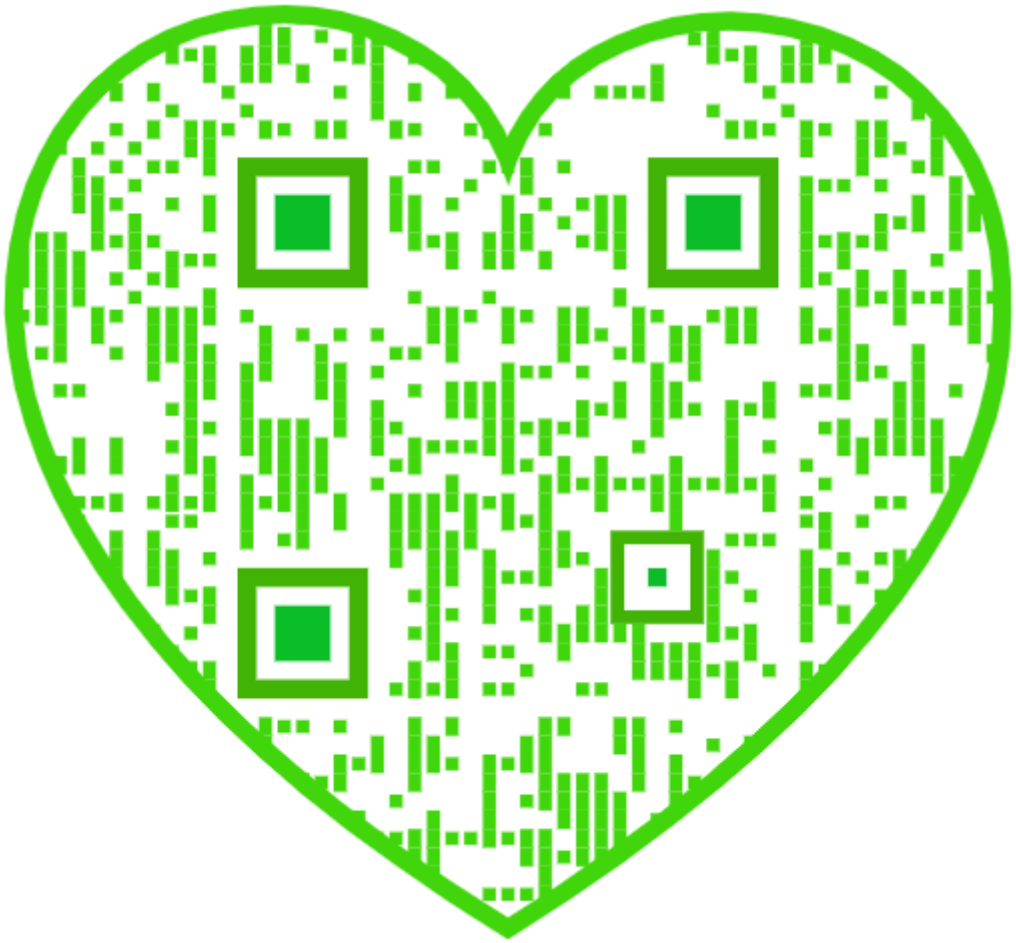

SCIENTIFIC AMERICAN

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

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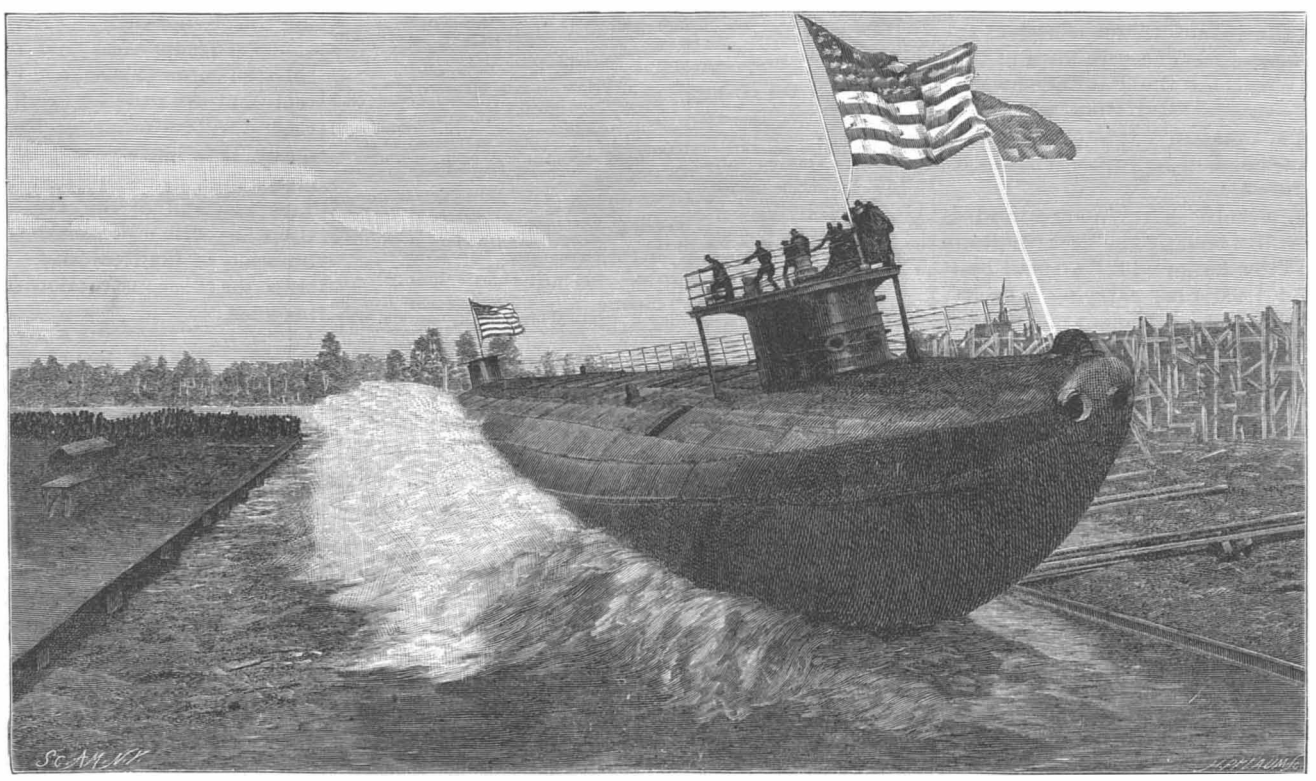
THE McDOUGALL WHALEBACK STEEL VESSEL.

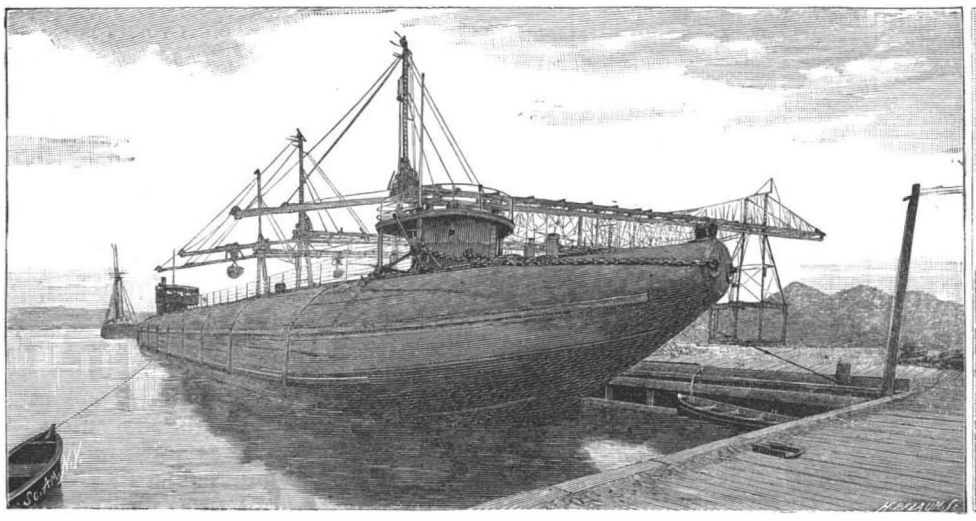
The old ballad commencing "In the North Sea Lived a Whale" has its use now in a facetious adaptation of this line to the needs of a souvenir issued by the people of Superior, Wis., in commemoration of the launching of the first two vessels of the McDougall whaleback pattern, built at the shipyard in that city, an event that took place on the afternoon of the 15th of November last. The two boats went into the water sideways, and floated in their slips as if they were in their natural element.

The somewhat surprising information to an Atlantic coast seaman is contained in the recent report of the Commissioner of Navigation, in which it is stated that the registered tonnage of the vessels inspected on the Great Lakes for the year ending October 1 was in excess of the tonnage of those inspected on the Atlantic coast, and also in excess of the tonnage of those inspected on the Pacific and Gulf coasts and all the rivers of the United States combined. The development of the shipping interests upon this arm of the Atlantic within the past three years has certainly been marvelous, and is a vast testimonial to the importance of that inter-state commerce which is largely the product of the past thirty years. Less than ten years ago a steam propeller of 1,200 tons registry was a large carrier upon the Great Lakes, and its carrying capacity was generally limited to about an even tonnage with its registry by the cumbersome power used and the amount of internal "works" deemed necessary to give it strength and solidity. But since 1885 the size of the lake steamer has gone up as high as 1,900 tons registry, and with a common though varying carrying capacity of from 2,000 to 3,000 tons, with some vessels of 4,000 tons capacity.

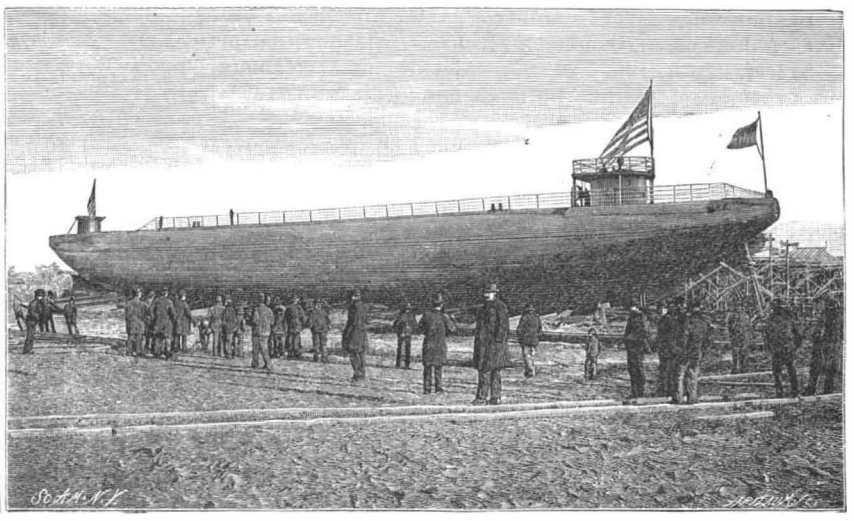
The sailing vessel is rapidly passing into the limbo of forgetfulness, and the deep and fast steamer is gathering to itself the business of the lake carrying trade. The lumber traffic still adheres to the sailing vessels, but



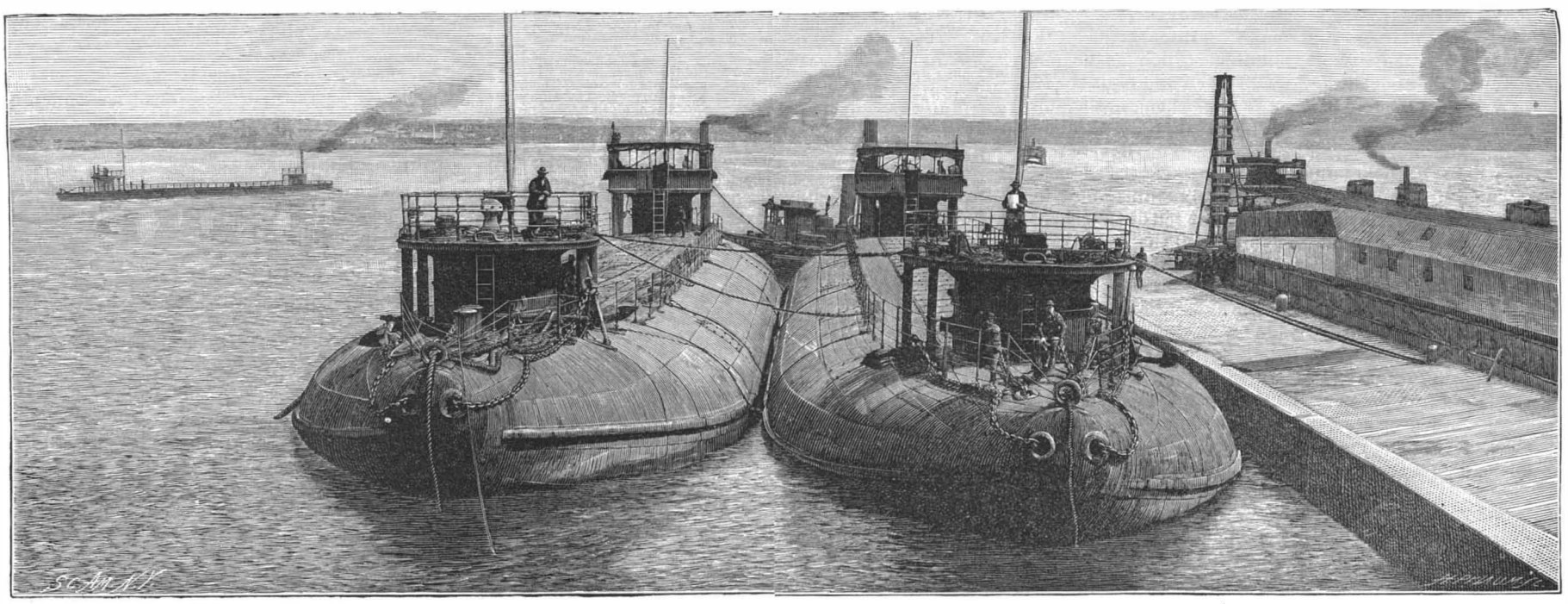
LAUNCHING OF THE JOSEPH L. COLBY, AT SUPERIOR, WIS.



WHALEBACK BARGE No. 104.



THE COLBY IN DRY DOCK.



TWO WHALEBACK BARGES.

WHALEBACK STEEL MERCHANT BARGES.

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iron ore, coal, wheat, flour, and merchandise go to the steamers for low rates and quick transit. And the present tonnage of the lakes is kept in an absorbing chase of distances by the enormous traffic turned over to the vessels by the railroads at deep water terminals like Chicago, Buffalo, and Superior.

In the mad rush of invention upon the land, marine architecture was allowed for a quarter of a century in this country to suffer somewhat. Land transportation absorbed all the powers of men's invention. But it was only a slumber for a season. Cheap transportation between the East and West became so important a factor that human nature could not resist the pressure, and so it happens that from the deep water's end in the middle of this continent, where land and water have their final junction, so to speak, from the head of Lake Superior, within dinner call of the farmers of Minnesota and Nebraska comes the latest and most wonderful innovation on marine architecture that has met the waters since Fulton's steamboat was put afloat. Alex. McDougall, of Superior, Wis., an old lake vessel master and agent, is the inventor, and is now at the head of the practical operations of a ship yard at that place which has keel blocks for the simultaneous construction of ten steel vessels, and from which the American Steel Barge Company, the owner of the plant and patents, expects soon to turn out 52 vessels per year, or one each week.

These vessels are built both as tow barges and as steam propellers. The first boat of the fleet (there are now eleven afloat), the tow barge "101," a small craft of 437 tons registry and 1,400 tons carrying capacity, excited unlimited ridicule and amazement among lake vessel builders, but her cost was only $45,000, and in two seasons she has netted her owners over $70,000, in the face of active competition, so that the laugh is now differently located. This boat was built in the summer of 1888, and was immediately denominated "the pig" by vessel men—a name that clings to all of her kind.

The first steam propeller, the Colgate Hoyt (named after the president of the American Steel Barge Company), was built in the winter of 1889-90, and has been in successful commission during the season of 1890 in the ore, grain and coal carrying trade between Superior and Lake Erie ports. She carries 2,800 tons of iron ore on a 15 foot draught, and readily makes 12 miles an hour with a tow barge in charge carrying 2,400 tons.

The Joseph L. Colby, launched November 15, is a somewhat smaller vessel than the Colgate Hoyt, being designed for passage through the Welland Canal and St. Lawrence River to Montreal. Her dimensions are as follows: Length over all 265 feet, width of beam 36 feet, depth of hold 22 feet. All subsequent steamers of this pattern will be built 38 feet beam and 24 feet depth of hold.

The tow barges 102 and 103 are of 1,132 tons registry and 3,000 tons carrying capacity; the tow barges 104, 105, 107, and 109 are each of 1,216 tons registry and 3,300 tons carrying capacity.

The Colgate Hoyt is registered at 1,008 tons, and 3,000 tons carrying capacity, with a speed of 15 knots per hour on 800 horse power. This statement will be understood when it is said that the fine steamers on the lakes of 1,800 tons registry, 15 knots speed and 3,000 tons carrying capacity, require 1,600 horse power for their work.

The "whalebacks" are all built upon the same pattern. They are round decked, flat bottomed, and ended up like the pointed end of a cigar. The wheel house on the tow barges is in a mere turret, and the men's quarters (it takes five to man one of them) are under the wheel house. On the steamers, the cabin and wheel house are set up on three turrets. These are the peculiarities that make of these boats a complete revolution in ship building. There is no ponderous bulk above the water to catch and fight the sea in a storm. The water washes over them, not against them. The round deck may make of them the most formidable naval vessel ever built. The flat bottom may make of them famous river boats.

The ship yard at Superior has six "slips" and ten piers or ways for keel blocks, so that ten of these boats can be under construction at one and the same time. And Manager McDougall speculates with some enthusiasm upon the fleet of "steam pigs" which he will send to the St. Lawrence in the fall of 1891 to engage in the Atlantic coasting trade for the winter season.

There is at present a whaleback tow barge lying on a dry dock in New York City, that was constructed at the Erie Basin for the coast and river trade, while two McDougall propellers are expected here in a short time, one of which is to be sent across to Liverpool and one to Puget Sound, on the Pacific coast.

CONTRACT has been let for the construction of a railroad from San Diego to San Quentin, Lower California, a distance of 162 miles. The road is to be built as soon as the Mexican government approves the survey. A cargo of supplies for the road is now on the way from England. The company is to receive $8,000 per mile subsidy from the Mexican government.

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Contents.

(Illustrated articles are marked with an asterisk.)

Bacilli, tuberculous, in sputum... 6
Barges, great, for lake traffic*.... 1
Bills, financial, drawing*..... 8
Books and publications, new..... 11
Chairs, theater, rack for, Hermann's*..... 6
Eagles, a flight of..... 3
Electrical block system, Guiley's* 4
Electricians, wealthy..... 5
Electricity in the printing office.. 4
Exhibition, Venetian casino at... 2
Fishing, electric light..... 9
Friction, the law of..... 10
Grass collector for lawn mowers, Latham's*..... 5
Gunner's arm rest, Sproul's*..... 6
Integrity of quality..... 6
Inventions, American, in medicine, etc..... 10
Inventions recently patented..... 11
Jet propulsion..... 10
Lard, cotton oil in..... 6
Launching, sidewise, of whaleback barges*..... 1
Lead pierced by insects..... 10
Lubricants, mineral, resin oil in*. 4
Microscopy, suggestions in*..... 5
Moon, heat from the..... 4
Navy, fast boats for the..... 2
Notes and queries..... 11
Patents granted, weekly record 12
Phosphate beds of Southern States..... 7
Photographic outfit, one-dollar*. 5
Population of British cities..... 3
Railway block system, electrical* 4
Resin oil in mineral lubricants... 4
Rifle "kick," fracture from a..... 6
Saltpeter caves, American..... 3
Tea, compressed..... 4
Telephone, the cosmical..... 10
Tin plates, how made..... 4
Twelve inch gun No. 1..... 9
Uranium in the Black Hills..... 5
Whale, a, rammed by a war ship* 6
"Whaleback" steel vessel, the McDougall*..... 1
Wire, great spools of*..... 9
Wires, ground, right to use..... 9
Wood for printing press..... 9

TABLE OF CONTENTS OF SCIENTIFIC AMERICAN SUPPLEMENT No. 809.

For the Week Ending July 4, 1891.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ART.—How Statues are Made.—The technique of the sculptor's art.—How the model is made for a statue.—The reproduction in plaster and in marble.—The casting of bronze statues..... 12920
Shell Flowers.—An exceedingly interesting system of decorative art.—The manufacture of imitation flowers from shells.—3 illustrations..... 12919
II. ASTRONOMY.—Recent Conceptions of Arcturus.—By WM. H. KNIGHT.—A most graphic and vivid account of recent investigations of Arcturus, of his motion, size, and probable future..... 12930
III. BIOGRAPHY.—Edmund Becquerel.—An eminent member of an eminent family of scientists.—His life, achievements, and portrait.—1 illustration..... 12924
IV. BOTANY.—Pyramidal Bellflower.—A fine plant, long cultivated in English gardens.—Description of its method of cultivation and propagation.—1 illustration..... 12933
The General Features of the Vegetation of Louisiana and Adjoining Region, and its Products in Relation to Pharmacy and Allied Industries.—By CHARLES MOHR.—Economic botany of the Southern United States, with special reference to medical uses.... 12929
V. CHEMISTRY.—Fertilizer Analysis.—Methods of analysis adopted by the Massachusetts Agricultural Society.—Full details of processes..... 12933
Manganese in Iron and Steel.—By L. BLUM.—Defectsof Rurup's method of determining manganese..... 12934
The Purity of Benzene.—By C. LIEBERMANN and A. SERGEWETZ.—Detection of carbon bisulphide in benzene.—Ill effects of its presence therein..... 12934
VI. CIVIL ENGINEERING.—An Enlarged Waterway between the Great Lakes and the Atlantic Seaboard.—By E. L. CORTHELL.—A suggestion for river and canal work to establish ship transit between the Northwest and the Atlanic Ocean, with tables of sailing distances and an examination of ship railways.—Discussion on the paper..... 12924
Comparison of Water Supply Systems from a Financial Point of View.—A most elaborate table, giving the engineering and financial data of a vast number of American waterworks..... 12927
VII. ELECTRICITY.—On the Magnetization of Metals.—By THOMAS T. P. BRUCE WARREN.—Some notes upon the effect of magnetization on the volume of metals, and a torpedo finder based upon the facts noted..... 12922
The Electric Tramway at Budapest.—By F. UPPENBORN.—A system of electric road with slotted conduit directly under one of the rails, full details of its practical operation.—1 illustration..... 12923
The New England Portelectric Company's System of Transportation.—A practical test of the portelectric system, a 2,794 foot track, with plant, now erected at Dorchester, Mass.—3 illustrations 12923
The Telephone as an Optical Current Measurer.—By MAX WIEN.—A curious application of the telephone for determining current strength, especially for alternating currents..... 12922
VIII. GEOLOGY.—Iron Ore Deposits.—By R. W. RAYMOND.—The origin of the Scandinavian ore beds and probability of their sedimentary formation..... 12930
IX. MECHANICAL ENGINEERING.—The Riveted Joints in Boiler Shells.—By WILLIAM BARNET LE VAN.—The proper construction of boilers, with examples from natural practice of faulty work.—10 illustrations..... 12927
X. MEDICINE.—New Remedies.—A list of recent remedies, with the cases for their administration and the proper dose..... 12931
Effects of Tuberculine on Monkeys.—Koch's remedy applied to monkeys.—A curious experiment..... 12931
XI. TECHNOLOGY.—A Two-Bottle Marking Ink.—By R. WRIGHT.—Various marking ink formulæ, giving excellent results on practical trial..... 12920
The Sources and Applications of Borax.—By E. L. FLEMING.—The many applications in the arts of this interesting salt, with notes on its preparation and manufacture..... 12921

THE CASINO AND PIER AT THE EXHIBITION.

One of the novel buildings at the Exposition will be the Casino and pier. The Casino, which will stand out in the lake 1,000 feet from the shore, is intended to reproduce Venice on a small scale in Lake Michigan. Burling & Whitehouse, of Chicago, have completed the design for this structure, and the architecture is of course of Venetian order.

The Casino will be built on piles and connected with the shore by a pier 80 feet wide. The base dimensions of the Casino will be 180 by 400 feet. The building will consist of nine pavilions, two stories in height, and, with the exception of the central one, 80 feet above the surface of the water. The center pavilion will be 180 feet high. There will be communication between the nine pavilions both by gondolas and bridges. Completely surrounded by water, this structure, with its fleet of boats and numerous waterways, is expected to have a decidedly Venetian flavor. Surrounding the central pavilion will run a gallery fifty-six feet wide. The pier connecting the Casino with the shore will form a broad promenade. At the west end of the pier will stand the thirteen columns designed by Sculptor St. Gaudens to represent the thirteen original States. In front of the Casino will be a harbor for small pleasure craft. At night this harbor will be lighted by incandescent lamps sunk beneath the surface of the water on floats. The material of the Casino will be of wood and the walls will be covered with staff. A striking combination of high colorings will be effected. The contract for the construction of the pier and Casino has been let.

FAST BOATS FOR THE NAVY.

We have repeatedly urged upon Congress the importance of high speed for some of our war vessels. Some progress has been made, but our neighbors still excel us. As yet we have nothing that can compare in speed with the best English and German mail steamers regularly employed between New York and Europe. Some of these ships have maintained a speed of over 20 knots per hour throughout the Atlantic voyage. The regular speed rate of several of them is 19½ knots at sea. They are specially built for naval service whenever the need for them occurs. No United States ship could compete with them at sea in point of celerity.

The advantage of high speed is conspicuous in the naval warfare now going on in Chile. At the outset of the war the insurgents had a great advantage in holding possession of the principal vessels belonging to the navy. There remained, however, to the government a few boats, among them two gun boats, not very large it is true, but they are among the fastest in the world, the Almirante Lynch and the Almirante Condell. In consequence of their high sea speed and rapidity of motion they steam with great celerity from port to port and threaten the enemy. They have become the terror of the insurgent fleet, which comprises ironclads such as the Huascar, Esmeralda, and Cochrane. The two gunboats in question lately torpedoed and sank the rebel ironclad Blanco Encalada, which was the strongest and proudest ship they had. This was a dreadful blow to the rebels.

An eminently successful trial of a torpedo boat just completed by Messrs. Thornycroft & Co., for the government of the United States of Brazil, took place in the estuary of the Thames on the 2d of June. The new vessel is 150 feet long by 14 feet 6 inches beam, there being four torpedo guns suited for the 14 inch Whitehead torpedo. Two of these torpedo tubes are mounted on racers on deck and two under deck in the bows, arranged not in the ordinary way, but with gear enabling them to be protruded through doors in the skin of the boat. The machinery consists of two sets of triple compound engines, supplied with steam by two Thornycroft water tube boilers. The trial consisted of two parts—first, a series of six runs on the measured mile, with a load of nineteen tons on board, during which a speed of twenty-five knots was guaranteed by the builders; and, secondly, a continuous run of two hours' duration, during which a speed of twenty-four knots was guaranteed. The results of the six runs were as follows:

	Knots.	Mean revolutions per knot.
First run, with tide	27·629	1,065·5
Second run, against tide	23·529	1,289
Third run, with tide	28·346	1,034
Fourth run, against tide	23·377	1,200·5
Fifth run, with tide	28·346	1,042·3
Sixth run, against tide.	23·829	1,282·5

The mean of these speeds computed by the Admiralty method being 25·858 knots, Messrs. Thornycroft's guarantee was more than fulfilled. The mean number of revolutions required to do a knot was found to be 1,165·4. At 1:18 P. M. the vessel was put upon her two hours' run, and at 3:18 it was found that the mean number of revolutions of the screws amounted to 59,174, which, being divided by 1,165·4, the number required to complete a knot in still water, gives a distance of 50·775 nautical miles, or 58·4 statute miles, covered in the two hours. This

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showed an average speed of 25·387 knots, which, it is claimed, is the greatest distance ever run and highest speed maintained by any vessel in the time. During the run steam was blowing off from both boilers and the pressure of 210 pounds per square inch was maintained with ease, there being an air pressure in the stokehold of only one and one-half inches of water.

It is encouraging to think that our own navy is likely to have one little fast torpedo boat in the course of a year, although it will not be equal to the Brazilian vessel.

Secretary Tracy has issued an advertisement inviting proposals for the construction of a steel twin-screw torpedo boat. The proposals are to be opened on Aug. 18. The boat will be about 120 tons displacement, and must be completed within twelve months after signature of the contract. The proposals may be under the department's designs or in accordance with the bidder's designs. The minimum speed is twenty-four knots per hour, and provision is made for a bonus ranging from $2,500 to $3,500 for every quarter knot speed above twenty-four knots and for deductions of $2,500 for every quarter knot deficiency. The vessel may be accepted if she makes twenty-two knots per hour.

The six torpedo boats lately built by Yarrow for the Argentine government had a speed of 24½ knots, on a displacement of 76 tons. They are 130 ft. long, 13½ ft. beam.

American Saltpeter Caves.

BY H. C. HOVEY.

The uses of saltpeter, or the nitrate of potash, are well known, in the curing of meats, glass making, metallurgy, pharmacy, pyrotechnics, and especially in manufacturing gunpowder. It contains 54 parts of nitric acid to 46 parts of potash; and one volume of it is said to hold as much oxygen as 3,000 volumes of ordinary atmospheric air. Hence it has been called "a magazine of oxygen in a solidified form." The result of suddenly liberating such an amount of imprisoned gas, by ignition with charcoal and sulphur, is the familiar explosion that gives gunpowder its terrific force.

The chief source of native saltpeter, from the remotest antiquity down to modern times, has been the great valley of the Ganges, in India, where it occurs as an efflorescence of the soil, having only to be purified by crystallization to fit it for the market. The business was formerly a monopoly of the East India Company, but it gradually passed in the hands of various private firms that annually export from Calcutta about 500,000 cwt., fully one-half of which goes to Great Britain. "Nitraries" are artificially made in Sweden and other parts of Europe. Quantities of the nitrate of soda are also imported from Chili, Bolivia, and Peru, from which saltpeter is obtained by double decomposition.

The manufacture of saltpeter in the United States has curiously ebbed and flowed with our military exigences. In times of peace we have had better ways of investing capital and labor than in producing what can be more cheaply imported from India or Chili. But in times of war, while the supply has been cut off, the demand has inevitably increased. When an embargo was laid on our commerce duing the war of the revolution, our fathers were thrown on their own resources in all respects; and thus, at the very time when gunpowder was most needed, it was most difficult to be had. Thomas Jefferson, who first drew public attention to the natural wealth of the Old Dominion, is our authority for the statement that at the crisis named more than 10,000 pounds of the nitrate of potash were extracted from the soil found in the caverns of the Kanawha, Greenbrier, and Cumberland valleys. The Madison Cave, in the Shenandoah Valley, enjoyed the unique distinction, according to its present owners, of having been worked for nitrate during three wars, namely, those of the revolution, of 1812, and of the secession. It is probable that the Confederate powder mills were altogether dependent on local supplies, from this and other caves in Virginia and Tennessee, especially the extensive works still visible in the famous Nicojack Cave, that begins in Tennessee and runs down into Georgia, and which I had an opportunity to examine last March.

My inquiries have been more especially directed, however, to the saltpeter works of the Ohio Valley, where at one time the speculative excitement ran very high, being, on a small scale, analogous to the subsequent gold fever of California. The pioneers who followed in the wake of Daniel Boone were in daily peril from wild beasts and more savage Indians; and yet they found the importation of ammunition almost impracticable on account of its expense and difficulty. They applied to the executive council of Virginia for 500 pounds of powder, and were curtly told in reply that the State "could only *lend* it to them, as to friends in distress, but could not *give* it to them, as to fellow citizens." This sort of aid was promptly rejected, and a project was immediately set on foot to create the independent State of Kentucky. This threat led to concessions whereby the region was made a county, instead of a State, and on the other hand the powder was given outright, instead of being merely lent; and on that fact hung the connection between Virginia and her splendid western domain. This was in 1776, and serves to show the scarcity of ammunition when most needed.

The lesson was not lost. The Kentuckians at once sent forth such strolling chemists as happened to be among them, to hunt for niter beds. These were found in the "rock houses" at the heads of ravines, in crevices amid the cliffs, and the sandstone itself was sometimes found to be rich in niter, whence may have come the term saltpeter, or literally "stone salt." But the main deposits were found in the great limestone caverns of the region. Solid masses of the coveted mineral were occasionally met with, weighing from 100 to 1,600 pounds each; and the workmen hunted for such lumps as others might have sought nuggets of gold. Yet, as is usually the case, the more systematic work paid the best in the long run. As many as twenty-eight saltpeter caves were worked in Kentucky before the year 1800, from which, up to that time, more than 100,000 pounds of niter had been extracted, with more than 2,000,000 pounds in sight and awaiting the hand of the miner.

In 1806 Dr. Samuel Brown, of Lexington, Ky., made a journey of a thousand miles on horseback in order to lay the facts as to this novel form of industry before the American Philosophical Society, of Philadelphia. His lengthy report is at hand as I write. He described what was being done in various localities, in both limestone and sandstone caves; but dwelt particularly on the works in the Great Cave on Crooked Creek, in Madison County. This latter cave had two mouths, 646 yards apart, on opposite sides of a mountain, with a level floor running completely through, like a public highway, beside which flowed a living stream. Some seventy men were employed, with ox carts. The oxen were trained to traverse their subterranean road in perfect darkness and without a driver. Brown advanced the curious theory that "potash, soda, lime, and magnesia are nothing more than varied forms and proportions of the same constituent ingredients." But however crude the notions, imperfect the tools, and rough the hands that wielded them, the historic fact remains to the credit of the pioneers, too often forgotten by the historian, that our national life was saved, during the war of 1812, by the salt that was found in the caverns of Kentucky, Indiana, and Virginia. And this was to a considerable degree likewise due to the prompt response made by men of learning and enterprise on hearing Dr. Brown's appeal to them to prove their "concern for the glory and defense of our country" by investigating as to "this salt, so valuable in time of peace, and so indispensable in time of war." Among influential men whose attention was thus directed to the subject were Mr. Gratz, of Philadelphia, and Mr. Wilkins, of Lexington, who formed a partnership for developing the novel industry.

These gentlemen shortly became joint owners of the Mammoth Cave, in Edmondson County, Kentucky, employing Mr. Archibald Miller as their agent. The latter, after due examination, reported with enthusiasm that there was in this one cavern "a sufficient quantity of saltpeter to supply the whole population of the globe." He set a large number of negro miners to work, who collected the nitrous earth from the various rooms where it had been deposited by nature, in many cases digging down from ten to thirty feet and finding the earth still impregnated with the salts. On an average every bushel of earth yielded at least two pounds of niter. The "peter dirt," as the miners called it, was carried by means of ox carts along underground roads, themselves monuments of industry, to hoppers of simple construction, each with a capacity of from 50 to 100 bushels. Cold water, conveyed by wooden pipes from the cascade at the cave's mouth, was poured on each charge. In a day or two a solution of the salts would run into the great vats below the hoppers, whence it was pumped into a second set of pipes so tilted as to let the liquor flow out of the cave. After boiling a while in the open air it was run through hoppers containing wood ashes; the result being, if skill had been used in mixing materials, a clear solution of the nitrate of potash, which was left in the troughs for cooling. In about 24 hours the crystals were ready for transportation. To make 100 pounds of saltpeter, 18 bushels of oak ashes were necessary, or 10 of elm ashes, or 2 of the ashes made by burning the dry wood in hollow trees. The superiority of this latter kind of ashes explains why the interiors of so many hollow forest trees have been burned out and the trees themselves left standing. The process as described above was the same that was adopted at the Wyandot Cave, in Indiana, and elsewhere through the limestone regions of the Ohio Valley. As a curious relic of those days, there is a law in some of the Western States requiring the owners of saltpeter caves to fence them in, to prevent the cattle from killing themselves by licking the casks and troughs, even a small portion of the salts being fatal to them. As an indication of the immense industry in the line of manufacture under consideration it is stated that the contract for the supply of the fixed alkali for Mammoth Cave alone, for the year 1814, was to the amount of $20,000.

All this was long before the days of railroads. Wagon roads, even, were few and ill constructed. Communication between the settlements was mainly by bridle paths "blazed" by cuts in the trees to guide the traveler. The primitive pack saddle was in use here for a century after it had been superseded in the old world, and it was by this means that hardy mules carried the dry saltpeter from the Western caverns over the mountains to the Eastern powder mills. It is stated that at a somewhat later day gunpowder was largely manufactured within the limits of Kentucky itself. But however that may be, the demand for native saltpeter fell off to such a degree, shortly after the treaty of Ghent, that the works were abandoned, and the caverns where they had been located were deserted, or else valued only as places of exhibition on account of their natural curiosities.

No thoughtful visitor can fail to be impressed by the relics yet remaining at the Mammoth Cave, and elsewhere, of these primitive saltpeter works. In Dixon's Cave, which is really a part of the Mammoth Cave, the rocky fragments piled transversely across the floor, like successive stony billows, 25 feet high and 40 feet in diameter, in a vast hall 75 feet wide and 125 feet high and 1,500 feet long, are what was left after the "peter dirt" had been carted out to the hoppers. The subterranean cart roads in Mammoth Cave are well marked, even to the ruts and hoof prints. Cribs are to be seen where the oxen were fed. The huge vats, long pipes, and tall pump frames are, for the most part, in excellent preservation. The mountains of lixiviated earth heaped along the road for hundreds of yards tell the magnitude of the business that long ago expired. The rocky chapel also remains, far below the surface, where the rude pioneers held their Sunday services by lamplight. Now and then rusty lamps are found in crevices where they were lost to the sorrow of their owners, who could not replace them short of a trip to Lexington. The legends told by the guides as to the strange adventures of the swarthy miners as they strolled through haunted halls unearthing now and then a gigantic skeleton, or finding some regally clad mummy, have a delightful flavor of antiquity, and also, in general, a certain substratum of truth. And yet, with all its interest and vital importance in connection with our great American struggles from first to last, what is here recorded is a chapter of history almost forgotten by the general public, and rarely hinted at except in local annals and guide books.

Population of British Cities.

The populations of some of the principal English towns, 1881 and 1891, are given below. The rates of increase between the two periods in the several towns are also given. It will be noticed that in Liverpool only is there a decrease since 1881:

	1881.	1891.	Increase per cent.
London	3,815,544	4,211,056	10·4
Liverpool	552,508	518,000	*6·2
Manchester	462,303	505,300	9·3
Birmingham	400,774	429,200	7·1
Leeds	309,119	367,500	18·9
Sheffield	284,508	324,200	14·0
Bristol	206,874	221,700	7·2
Bradford	194,495	216,300	11·2
Nottingham	186,575	212,000	13·6
Salford	176,235	198,800	12·4
Newcastle	145,359	186,300	28·2
Hull	165,690	183,800	10·9
Portsmouth	127,989	159,200	24·4
Leicester	122,376	242,100	16·1
Oldham	111,343	131,500	18·1
Sunderland	116,542	130,000	12·3
Cardiff	82,761	128,900	55·7
Blackburn	104,014	120,100	15·4
Brighton	107,546	115,400	7·3
Bolton	105,414	115,000	9·1
Preston	96,537	107,600	11·4
Norwich	87,842	100.900	14·9
Birkenhead	84,006	99,200	18·1
Huddersfield	86,502	95,400	10·3
Derby	81,168	94,100	16·0
Plymouth	73,794	84,200	14·1
Halifax	73,630	82,900	12·5
Wolverhampton	75,766	82,600	9·0

* Decrease.

A Flight of Eagles.

A Russian lettter says: A curious and unusual sight has just been witnessed by the inhabitants of Bjelgorod in the south of Russia. A few days ago an enormous flight of eagles were seen to fly past the town and settle in an adjacent forest. The woodmen who were in the forest at the time fled in dismay from the place. It is well they did, for when these unwelcome visitors had taken their departure, it was found that they had devoured ten horses, several sheep, and a vast number of smaller animals. The ground where they alighted was strewn with feathers, and all the birds of the neighborhood have been so terrified that they have flown away. Only one of the eagles was caught—a bird of immense size and belonging to a Siberian species. The eagles, which were several hundreds in number, flew away in a southwesterly direction. The peasants who saw this remarkable sight state that there were so many of them that for the space of several seconds their wings hid the sun from their sight.

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Compressed Tea.

Tablet tea is manufactured at Hankow in factories belonging to Russian firms there. It is made of the finest tea dust procurable. The selection of the dust is the work of skilled experts; the cost of the dust varies from 10d. a pound upward. This dust is manufactured into tablets by steam machinery. About two ounces and a half of dust are poured into a steel mould on a steel cylinder. The dust is poured in dry without steaming, and the pressure brought to bear is two tons per tablet. Great care is required in the manufacture and packing of tablet tea, and the cost is comparatively high. The tablets are wrapped first in tinfoil, then in expensive and attractive paper wrappers, and finally packed in tin-lined cases for export to Russia. The tea, it is stated, loses none of its flavor by being pressed into tablets, and, as tablet tea is only one-sixth of the bulk of leaf tea, it is most convenient for travelers, and also for importing into the remoter regions of Russia. The increase in the export of tea dust from Hankow to 726,729 lb. in 1890, from 140,933 lb. in 1889, is due to the fact that while Indian and Ceylon teas are ousting China tea from the British market, many consumers, being accustomed to the flavor of China tea, wish for it. To meet this demand grocers use China tea dust to flavor the Indian tea. All the tea dust exported goes to Great Britain. Lately a new commodity has come on the Hankow market, to which the customs give the name of log tea. It is an inferior tea with stalks packed in the shape of logs, which weigh from 8 lb. to 80 lb. each log. The tea is wrapped in the leaves of the *Bambusa latifolia*, and then reduced in bulk by binding round the log with lengths of split bamboo.

Heat from the Moon.

Mr. C. Vernon Boys has been making measurements of the heat of the moon by means of his very delicate radiomicrometer. His method was to focus the rays of the moon on the face of the radiomicrometer by a reflecting telescope of 16 inches aperture. In the case of a new moon, he found that the heat coming from its disk diminished as you passed from the convex to the concave edge, and that from the dark surface was so slight as not to affect the apparatus. The maximum radiation of heat came from points of the disk itself, not from its limbs. At full moon the maximum point was at the center of the disk. The side of the moon which had been exposed to the sun for fourteen days was not warmer than that which had been exposed for seven days. No sensible heat was observed to come from the stars.

Electricity in the Printing Office.

No discovery has yet been made and no contrivance has been introduced that will *absolutely* dissipate or nullify the disturbing effects of electricity in paper, either latent or generated by the revolutions of the press. Many employers have paid out considerable money to electrical experts and others who claimed to have discovered or to be in possession of infallible remedies for this trouble; but not one of them has squarely fulfilled the terms of his contract. We have studied the effect of wires connected with batteries and of wires connected with gas or other pipes leading to the ground; the latter on the principle of the lightning rod. While these do to a certain extent help to modify the action of electricity or the generation of it, they fall far short of doing it effectively and completely, and for that reason do not justify the outlay of much money upon them. Again, many printeries throughout the country are beyond the reach of those who could help them with the appliances described; are at an expense which, as we have just said, the modicum of benefit that would be derived would not justify. It is for this reason that we recommend to all who have trouble with electricity in paper the adoption of the simple and inexpensive but surprisingly effective remedy we now present.

In nearly every printery a bottle of glycerine is kept for one purpose or another. Take this bottle and a clean rag or other cloth, wet the cloth with water and wring it out well until it is only damp, then pour a little glycerine upon the damp cloth, and wipe the surface of the tympan sheet with it, only on that part of the sheet where the impression is, as it is there that reaction is effected—at the point of pressure. Do not put on too much glycerine, as it will wrinkle the sheet too much. Simply go over it as you would in oiling the sheet to prevent off-set, but do not saturate it. If you find that one application or wiping will not stop the trouble, go over the impression parts again in the same manner. Some kinds of stock are more susceptible than others, and call for an additional application.

This is the simplest and cheapest of all the remedies, and as good as any hitherto known.—*American Art Printer.*

GUILEY'S ELECTRICAL BLOCK SYSTEM FOR RAILWAYS.

An invention which will tend to prevent railway collisions, by giving a timely alarm to an engineer on a moving locomotive when approaching a standing or moving locomotive on the same track, and which will give notice of an occupied grade crossing, an open switch, an open drawbridge, or a car projecting from a

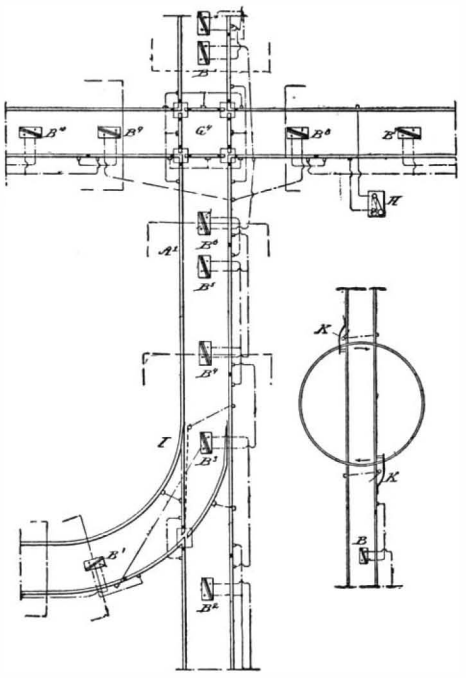
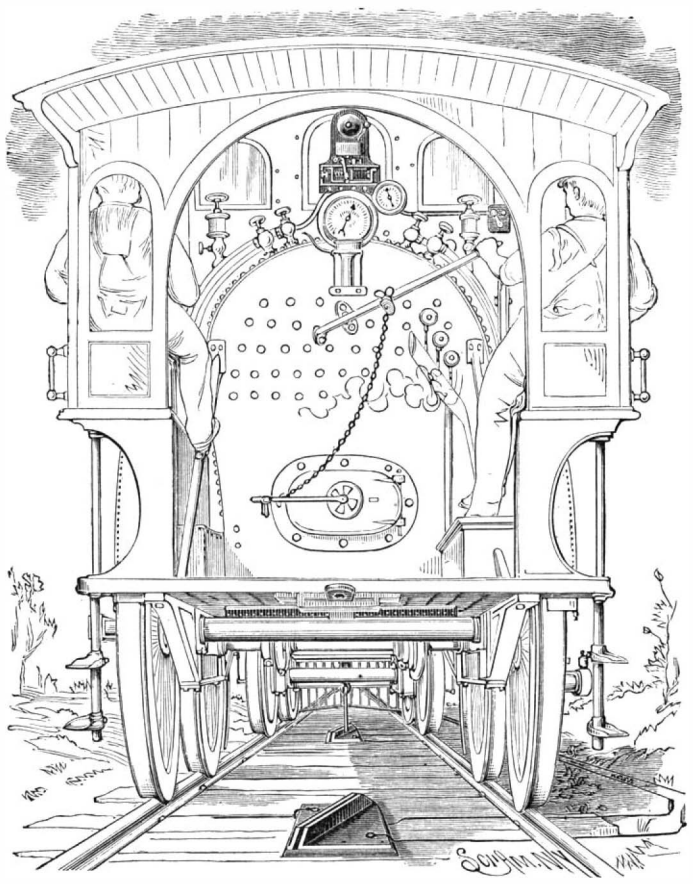


DIAGRAM OF GUILEY BLOCK SYSTEM.

side track over the main track, and which will afford a signal effective in daylight or darkness, on a straight or curved track, or in a tunnel, is one which would cover most of the causes of disaster on railways, and would prove a boon to travelers, and a paying investment for railways if generally adopted.

Such an invention has been made by Dr. A. H. R. Guiley, and has been patented in this and most other countries in the world.

According to this invention, which is illustrated in the annexed engraving, one of the rails is made a continuous conductor by connecting the rails electrically at the joints, and the other rail is divided into sections or blocks, and provided with electrical connections which overlap from one block to the other. Between the rails at suitable intervals, preferably at opposite ends of the blocks, are placed electric contact pieces, each formed of two plates insulated from each other and provided with vertical ribs arranged diagonally. These ribs lie in the path of an arm or "feeler" carried by the locomotive, and upon the locomotive is placed a battery and alarm mechanism.



NEW ELECTRICAL BLOCK SYSTEM FOR RAILWAYS.

The arrangement of the circuits is such that when a train is passing in one direction, the feeler strikes a set of contacts controlling the circuit arranged for trains passing in that direction. When the train passes in the opposite direction, the feeler strikes the opposite contact plate, securing opposite results. The feeler, which extends downwardly from the pilot of the locomotive, is capable of swinging laterally, and is protected so that it is not injured by the shock due to striking the contact plates, or other objects lying on the track.

In the cab of the locomotive is arranged an electrical alarm which is set off by the contact of the feeler with one of the plates, and continues to ring until the engineer readjusts it for another alarm. The inventor has devised an attachment to the feeler by means of which steam is taken through pipes and through the contact end of the feeler for thawing snow and ice that may accumulate upon the feeler or upon the contact plates.

This improved system applied to a railway furnishes a complete grade crossing protection, and a very efficient block signal, while at the same time, under certain conditions, it may be used as a train signal by which one train may signal to another.

In the annexed diagram, the contacts, B, B', etc., and the electrical connections, as arranged upon the main track, A', and branch track, and on opposite sides of the crossing, as shown in the diagram, protect the grade crossing, G^4, and the switch, I.

The switch, H, is provided for the use of the track master and others for signaling a train in case of necessity. The detached view shows the application of the invention to a drawbridge, J, the contact springs, K, in this case serving to make or break the connections as the bridge is closed or opened.

Mr. E. B. Cornell, 922 N. 19th Street, Philadelphia, Pa., has the business management of this invention.

Determination of Resin Oil in Mineral Lubricants.

Ten to 15 grms. of the lubricant containing resin oil, but no fatty oils, is gently heated on the water bath in a small flask with 5 vols. alcohol at 96 p. c., shaken up, and let cool down to the temperature of the room. The alcohol is then placed in a small Erlenmeyer flask about 7 cm. in height; the mineral oil which remained in the first flask is rinsed round (not shaken) with a few c. c. of 90 per cent alcohol, the solution poured into the second flask and heated upon a water bath which is slightly simmering, inclosing it within a beaker with the bottom cut off, to avoid too rapid condensation on the sides of the vessel. The heat is continued until the residue in the flask is free from bubbles. It is weighed when cold, and the residue is covered with ten parts by weight of alcohol at 96 per cent. If the residue consists entirely of resin oil, this quantity of alcohol will suffice for its solution. The alcoholic solution is treated as above, and the residue contains small quantities of mineral oils.—*L. Storch, Chemiker Zeitung.*

How Tin Plates are Made.

Following is a summary of the Morewood process of tinning plates now in use at the works of the United States Iron and Tin Plate Company, Limited, at Demmler Station, Pa.:

The plates are rolled in the ordinary manner into black sheets, eight of these sheets being rolled at one time, and after being sheared to size are placed in the "black pickle" bath of sulphuric acid, where all oxidation is removed. They are placed in an annealing furnace for 36 hours and are next passed through the cold rolls, receiving a smoothly polished surface, after which they are annealed again and put into the "white pickle," where they are thoroughly cleansed from any oxidation and are ready for the tinning process. The mode of putting on the coating of tin is a very simple one, and is begun by submerging the plates in a bath of palm oil until all the water disappears, the oil forming a flux for the tin, the first coat of which is received in the tin pot, the plates next being dipped into the "wash pot," and when taken out the tin is spread over the surface with a brush by hand. The final act in the tin coating process is in passing the plates through rolls running in palm oil, whereby the tin is evenly distributed and a smooth surface is obtained. There are 5 of these rolls used, 3 running on top of 2, and the plates make two passes through them, first being let down through the first and second of the upper set, and by a cradle arrangement are returned through the second and third. This completes the tinning operation proper, and the polish is obtained by rapid movements of the plates through bran and middlings, respectively, and then polishing with sheepskin. The result obtained at the Demmler works is a very excellent article of bright tin plate.—*Iron Indus. Gazette.*

AT the great factory of the Singer Manufacturing Company, at Elizabethport, N. J., a half hour is allowed for the noon-day meal, and it is invariably taken in the shops, or in the immediate vicinity. The whistle sounds, and instantly 500 or more boys or young men appear on a run armed with tin pails, some carrying a dozen. They immediately repair to some adjoining saloons, where the pails are filled with beer, which shortly before has been drawn into tubs so as to allow of expeditious dipping. The beer is then carried to waiting comrades in the factories.

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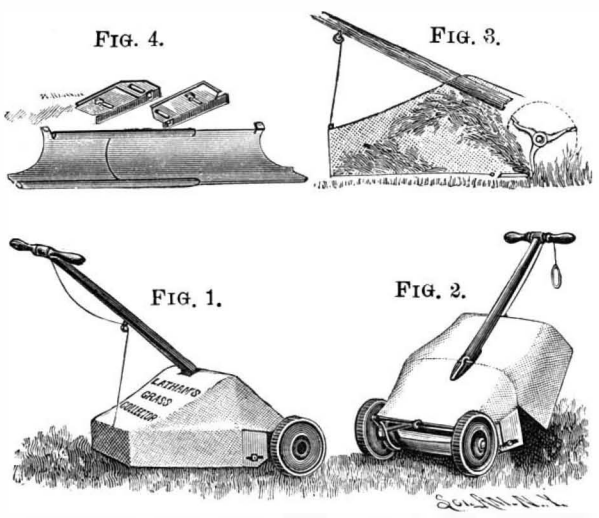
LATHAM'S GRASS COLLECTOR FOR LAWN MOWERS.

Every one who has used a lawn mower knows that the most disagreeable and most unsatisfactory part of cutting a lawn is raking the grass. The lawn usually looks well after the mower has passed over it, but the rake is likely to tear and pull up the roots of the grass more or less and make the lawn look rough. If the grass is gathered in a collector, the lawn is left smooth and velvety, and the grass thickens until the



LATHAM'S GRASS COLLECTOR FOR LAWN MOWERS.S.

ground is completely covered with a thick green mat. The grass collector shown in accompanying illustrations does away with the disagreeable work of raking a lawn and does away with the rake entirely. The collector is made of canvas, with a galvanized iron frame, and is readily attached to the mower, and weighing but 2½ to 3½ pounds, according to size, it does not add materially to the weight, and is so arranged as to be entirely out of the way. The cut grass can be instantly emptied by pulling the cord shown in Fig. 2, and as the collector is behind the cutter, the cut grass can be left in heaps or a windrow similar to that made by a horse rake, and is easily collected. In Fig. 3 we show the action of cutter, which throws the grass entirely over the cutters back into the canvas collector, so that it does not clog the machine. The plates shown in Fig. 4 are extensible, so as to fit almost any machine, and are all galvanized. This collector is the result of much experiment, and has been used with the most satisfactory results. It is very useful around borders, edges of walks and drives. It is quite inexpensive and thoroughly well made. It is manufactured by C. H. Latham, of Lancaster, Mass.

SOME SUGGESTIONS IN MICROSCOPY.

BY GEO. M. HOPKINS.

An object which always interests the microscopist, and excites the wonder and admiration of those who

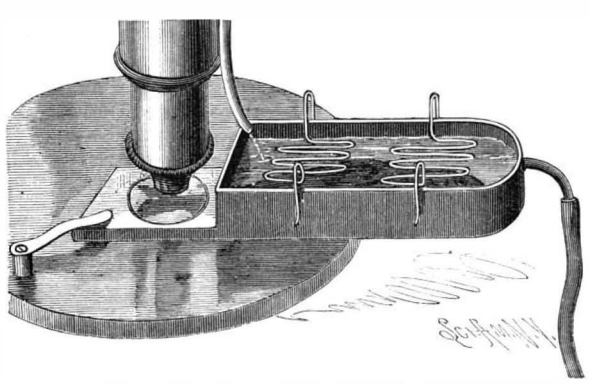


Fig. 1.—FISH TROUGH WITH GRIDS AND CONTINUOUS WATER SUPPLY.

regard things microscopic from the point of popular interest, is the circulating blood in living creatures. Nothing in this line has proved more satisfactory than the microscopic view of the circulation of blood in the tail of a gold fish. Thanks to Mr. Kent's invention of the fish trough, the arrangement of the fish for this purpose has been rendered comparatively simple and easy.

The trough consists of a metallic vessel provided with a thin extension at one end near the bottom furnished with glass-covered apertures above and below. The body of the fish between the gills and tail is wrapped with a strip of soft cloth, and the trough being filled with water, the fish is placed therein, with its tail projecting into the extension between the glass

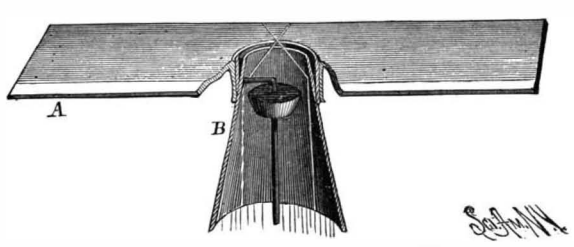


Fig. 2.—DARK GROUND ILLUMINATOR.

covers. The tank is arranged on the microscopic stage with the tail of the fish in position for examination. So long as the fish remains quiescent, all goes well, and the beautiful phenomenon may be witnessed with great satisfaction, but the subject soon becomes impatient, and at the most inopportune moment either withdraws its tail from the field or jumps out of the tank, thus causing a delay which is sometimes embarrassing.

The uneasiness of the fish is caused partly by its unnatural position, and partly by the vitiation of the water. The latter trouble has been remedied by the writer, by inserting a discharge spout in one end of the trough, and providing a tube for continually supplying fresh water. The other difficulty has been surmounted by providing two wire grids (Fig. 1), each having spring clips at their ends for clamping the walls of the tank. These grids are pushed downward near the body and head of the fish, so as to closely confine the little prisoner without doing it the least injury. With these two improvements the examination may be carried on comfortably for an hour or more.

In Fig. 2 is shown a simple device for dark ground illumination. Although it does not take the place of the parabolic illuminator, or the spot lens, for objectives of low angle, it answers an excellent purpose. To a metallic side, A, having a central aperture surrounded by a collar is fitted a funnel, B, of bright tin or nickel plated metal, which is provided with a downwardly projecting, axially arranged wire upon which is placed a wooden button capable of sliding up or down on the wire, the button being of sufficient size to prevent the passage of direct light to the objective. The light by which the illumination is effected passes the button, and striking the walls of the conical reflector, is thrown on the object.

Uranium in the Black Hills.

BY HERMAN REINBOLD.

Among the ores recently found in the Black Hills has been that rare and valuable mineral uranium. Although it has only appeared in one place, situated in the Bald Mountain district, it is found there in such large quantities as to warrant the prospect of early production of uranium salts, as well as the metal uranium, in the United States.

At present uranium mining is carried on only in two places in the world, namely at Annaberg, Saxony, and Redruth, Cornwall, and the scarcity of the mineral has been the cause of its not being used for a very important purpose, the manufacture of steel.

In Europe uranium has only been found in pockets in form of pitchblende, which is uranous and uranic oxide (40 per cent of uranous and 54 per cent of uranic oxide) combined with silica, lead, iron, and manganese; the other uranium ores appearing in such small quantities as not to be commercially valuable. The writer, who has made an examination of the different uranium ores on the Bald Mountain, has found the following minerals in a depth of only a few feet, the rock being of the archæan formation:

1. Uranit (uraniumglimmer) embedded in the rock and the seams, in greenish yellow scales, the vein running vertically and being forty feet wide on the surface. An analysis showed it to be (U_2O_3) 2 PO_4, Cu. As a source for uranium this mineral cannot be used, the costs of concentrating being too high.

2. Pitchblende. This mineral appears in seams, together with the above mentioned scales. From all appearances the rock contains large quantities in greater depths, the conditions being analogous with those at Cornwall. Its composition is U_3O_4, with iron, lead, magnesia, and manganese, also silica.

3. Uraniumochre (U_2O_3) 3 SO_3 and uranochalcit U_3O_4 (Fe, Ca) O SO_3, H_2O, in large bodies of kidney-shaped form; and

4. Trogerit, 3 UO_3, As_2O_5.

All these ores, with the exception of the first one mentioned, may be converted into uranium salts, which are commercially valuable. The chloride, nitrate, and sulphate of uranium are used in the manufacture of stained glass, producing a greenish yellow tint, peculiar to them. They are also used in coloring porcelain (black porcelain), and to some extent in photography. Germany and France are the principal consumers, and lately the output in Europe has decreased, and the price of uranium advanced materially, its cost being now $10 a pound.

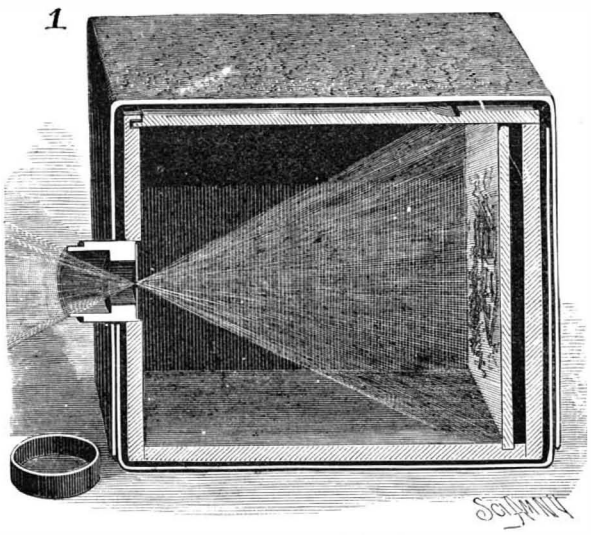
But the uranium find in the Black Hills may be of still greater importance in another direction, as the use of the salt in the manufacture of glass and porcelain is naturally limited.

Experiments and tests which have been made by the great steel and gun manufacturers in England and Germany have shown that the addition of a small percentage of uranium to steel increases its elasticity, and at the same time its hardness, to an extent that makes its use in the manufacture of guns, armor plates, etc., most desirable, but the scaricity of the material and especially the great difficulty in reducing the ore to metal makes the price of uranium steel too high. But since then great improvements have been made in the manufacture of sodium and electricity has been called to the aid of metallurgy; so if large deposits of uranium are found, the metal can be produced for the same price as aluminum. That there are large bodies of uranium in the Black Hills there can be no doubt, and it may be that in no distant time manganese and nickel steel will be superseded by uranium steel.

A ONE DOLLAR PHOTOGRAPHIC OUTFIT.

One would have supposed that the photographic craze had reached its climax when cameras costing from ten to fifty dollars were produced, together with conveniences which would enable almost any one to take photographs, but it appears that a large field has been left unoccupied. A camera has been needed which could produce a good picture with a small outlay.

Such a camera is shown in the annexed engravings. The instrument, together with the entire photographic outfit, including chemicals, is sold for one dollar. and this is the chief novelty of the outfit. This instrument is known as the "Glen Camera," made and sold by Ives, Blakeslee & Williams Company, of 294 Broadway, New York. Inasmuch as all the light used in this camera enters through a pinhole instead of a lens, a rather longer exposure is required than with an ordinary camera, but the results obtained are very good and pictures 2½ inches square are produced.



LONGITUDINAL SECTION OF GLEN CAMERA.

The construction of the camera will be understood by referring to the longitudinal section, Fig. 1. The light coming from the object passes through the pin hole, producing the image on the plate held by a groove in the rear portion of the camera box. As there are no plate holders, the camera must be taken to a dark room for an exchange of plates.

With the camera is furnished the materials and appliances shown in Fig. 2, consisting of six dry plates, a package of blue process paper, one ounce of hyposulphite of soda, a package of developing powder, card

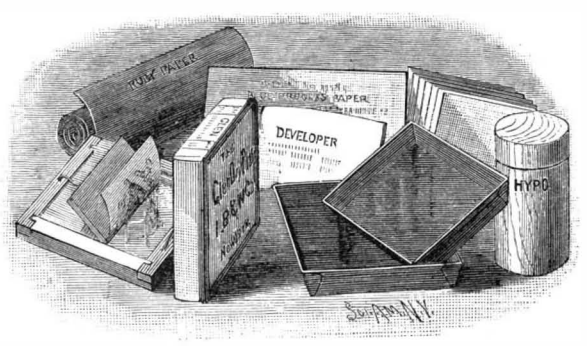


Fig. 2.—MATERIALS AND ACCESSORIES.

mounts, a printing frame, two japanned trays, together with a sheet of ruby paper for making a red light for the dark room. With these the amateur photographer may make, develop, print, and mount his pictures.

The camera is put up for mailing, and the package contains full instructions for making the exposure and all the operations for the completion of the picture.

Wealthy Electricians.

Lucre has smiled on the explorers in the field of electrical science, says the St. Louis *Globe-Democrat*. No scientific body in the country has so many millionaires as the American Institute of Electrical Engineers. At the top of the list is Alexander Graham Bell, whose profits on the telephone are represented by eight figures. Next comes Edison with a seven figure fortune. Brush, of electric light fame, and Elihu Thomson, whose financial future is perhaps brighter than any of the others now, are more than millionaires. Frank J. Sprague was a junior officer in the United States navy six years ago. He is now living in the mansion which was built for the Grants. His company sold out to the Edison Co., for $1,000,000, and half of it went to the inventor. Franklin L. Pope, of New York, and a score of others have independent fortunes. Most of these men were telegraph operators, and most of them began their experimenting and study without a dollar.

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The Actual Number of Tubercle Bacilli which may be Present in Tuberculous Sputum.

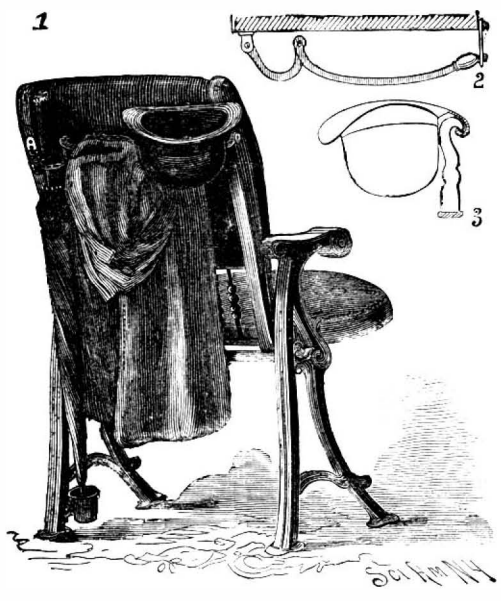
Dr. George H. F. Nuttall describes in the last number of the *Johns Hopkins Hospital Bulletin* a method by which he has been able to make accurate estimates of the actual numbers of tubercle bacilli present in tuberculous sputum. His communication is accompanied by cuts of the apparatus used. The methods heretofore employed for estimating simply the relative number of tubercle bacilli in sputum are condemned as unscientific. Nuttall's observations for the first time give us an idea of the enormous number of tubercle bacilli which a patient may expectorate in the course of twenty-four hours. In three cases undergoing the Koch treatment observations on the numbers of bacilli in the sputum were made every few days. In the first case the patient expectorated 2,000,000,000 bacilli during the twenty-four hours. After the patient was inoculated with tuberculin the number rose to between 3,000,000,000 and 4,000,000,000. After the inoculations ceased the number fell to what it had been originally. In the second case the number of bacilli varied between 20,000,000 and 165,000,000 on the days preceding the Koch inoculations, rose irregularly to 283,000,000 after the first inoculation, and fell to only 265,000 by the time the sixteenth inoculation had been reached. The third case showed a decrease from 70,000,000 before the inoculations to 12,000,000 and 19,000,000 after the treatment had been begun. A great rise in the number of tubercle bacilli in sputum was observed in the case of one patient (not undergoing the Koch treatment) to occur simultaneously with the appearance of elastic tissue. The number of bacilli in this case rose from between 300,000,000 and 400,000,000 to over 4,000,000,000. The accuracy of the method is shown by a number of test and culture experiments. Nuttall believes his method will prove valuable in any experiments where it is desirable to introduce a definite number of organisms into culture media, disinfectants, etc. In point of accuracy, it far surpasses the loop method generally employed. With such organisms as the tubercle bacillus this method will enable the experimenter to determine the number he is inoculating into an animal in a way that has not been possible hitherto. Inoculations made under such conditions will clearly show the difference in degree of virulence possessed by various organisms, as also the relation between the number of bacteria introduced and the progress of the disease. This method, finally, brings us a step nearer to solving the problem of the significance of involution and degeneration forms of bacteria.—*N. Y. Med. Jour.*

RACK ATTACHMENT FOR THEATER CHAIRS.

A novel rack for attachment to the backs of chairs or seats in theaters, public halls, and places is shown in the annexed engraving, Fig. 1 being a perspective view of a chair with the attachment applied, Fig. 2 a plan view of the attachment, and Fig. 3 a side elevation of the hat support.

This device affords a convenient support for a coat or other outer garment, a place for an umbrella or cane, and a standard for retaining a hat.

The principal part of the rack consists of a bar hinged at one end to one of the chair posts, curved outwardly for receiving the umbrella handle, and connected by a standard with the longer curved portion designed to receive a coat. The rack is pivoted to swing in an inclined plane, so that it will close automatically, and thus be prevented from offering any obstruction to a free passage through the row of seats.



HERMANN'S ATTACHMENT FOR THEATER CHAIRS.

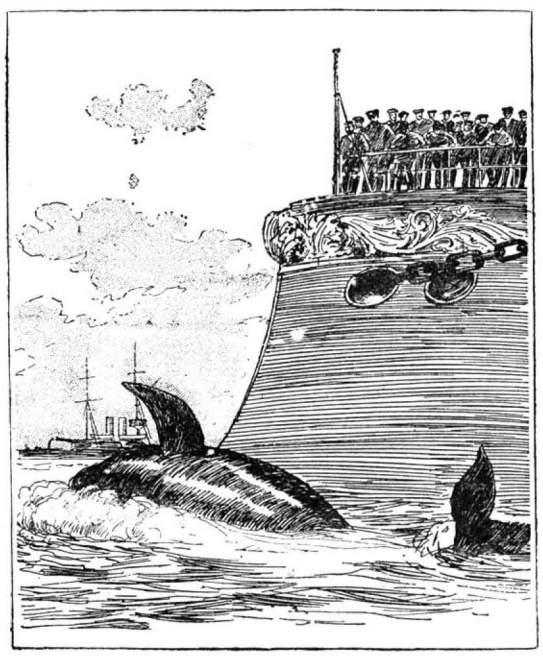
Although the rack is designed to close automatically, a hook is pivoted to the side of the chair for engaging the end of the rack arm and preventing it from swinging out accidentally.

To the free end of the rack arm is attached a standard, as shown in Fig. 3, having its upper end curved over to form a hook for receiving the turned-over portion of the hat brim, as shown in Fig. 3. To the leg of the chair below the curved portion of the rack designed for receiving the umbrella handle is secured a drip cup, in which the tip of the umbrella is placed.

This invention has been patented by Mr. George Hermann, 34 E. 10th St., New York.

A WARSHIP RAMS A WHALE.

While cruising with the Channel squadron, writes an officer of H. M. S. Immortalité, at nine o'clock on the morning of the 26th of May, in lat. 38 deg. 7 min. N, long. 9 deg. 19 min. W, steering S¼W (about



midway between Sardinia and the African coast), and going at a speed of thirteen knots, we struck a whale, about forty-five or fifty feet long, with our ram. It was unable to clear itself, which necessitated our going full speed astern, when the whale sank. It must have been asleep. At the same time we noticed another quite close on our starboard bow.

Fracture of the Clavicle from the "Kick" of a Rifle.

In the *Edinburgh Medical Journal*, Mr. James B. Simpson records the case of a member of a rifle club, a strongly built slate quarrier, thirty years old, who, after having fired several shots at 200 yards, feeling a "kick" not severe enough to cause actual pain, fired several more at 500 yards, lying down and resting on his elbows, and finally a shot at 600 yards, likewise in the prone posture. This shot broke the clavicle near its middle. The fracture was treated according to Sayre's method, and healed well. "When he recovered," says Mr. Simpson, "I asked the man to show me how he held his rifle while firing at 500 and 600 yards. On his raising the 'sight' and lying down and taking aim, the explanation of the fracture was clear. Instead of holding the butt of the rifle well on to his shoulder, he rested the upper end of the butt directly on the most prominent part of the clavicle. One could easily pass one's hand between the lower two-thirds of the butt and the man's chest, and it was therefore clear that when he fired all the force of the recoil came upon the clavicle. The farther he retired from the target, the more he necessarily elevated the muzzle of the rifle, and consequently the more did the upper end of the butt rest upon the clavicle, until at 600 yards so entirely was this the case that the bone gave way under the concentrated force."

Integrity of Quality.

Probably it is of as much importance to know how to retain a market as to know how to get it. Integrity of quality in goods is indispensable.

Not many years ago English manufacturers of cotton goods came near ruining valuable markets for such goods in the East, by sending to these markets miserable, sleazy, light weight goods loaded with size to give them artificial weight and the appearance of better cloth. These markets have never been the same to them since. Lost confidence is not easily restored. If, as a celebrated English statesman once remarked, "confidence is a plant of slow growth," it is certainly also a hard plant to nurse back into vigorous life when its roots have been cut by commercial deceit. A case in point occurs to us.

The late B. T. Babbitt, the famous and wealthy manufacturer of soap, established his business on the basis of strict commercial integrity, and his name was always honored among New York merchants. Some twenty years before his death, he made the European tour, leaving at the head of his business a young man of great energy and executive ability, but, as the sequel will show, of rather elastic principles. It was arranged with this deputy that in addition to his regular salary he might have during Mr. Babbitt's absence a certain share of all the profits of the business, whereupon immediately, as soon as his chief was out of sight, he put into practice a scheme of adulteration of the soap without a corresponding reduction of price. The soap selling freely upon the strength of its former reputation, the immediate returns were large, and the profits (?) divided unto the enterprising schemer from this selling out of his chief's business were, before Mr. Babbitt's return, enough to enable the trusted agent to retire with sufficient capital to start and conduct a large manufacturing business of his own. In narrating to the writer this disagreeable episode not many years after its occurrence, Mr. Babbitt said it cost him nearly a quarter of a million of dollars to remedy the injury to his business thus effected by a few months of sharp practice. He sent to his customers, all over the United States, letters requesting a return of the inferior goods, which he replaced with those of standard quality, and by a judicious but enormous expenditure in advertising gradually recovered the lost trade.

Cotton Oil in Lard.

The authors use Bechi-Hehner's silver nitrate test and Labiche's lead acetate reaction. For the former test 10 grms. of the filtered anhydrous lard are heated with 5 c. c. of silver nitrate solution (1 part silver nitrate, 200 alcohol, 40 ether, and 0·1 part nitric acid) in the water bath for fifteen minutes, shaking continually. The mixture, according to its proportion of cotton seed oil, turns more or less deeply reddish brown to black. Pure lard, poppy, olive, and sesame oils are not affected. For the Labiche test, 25 grms. of the clear melted sample are mixed with 25 c. c. of a solution of lead acetate, heated to 35°, and well mixed after the addition of 5 c. c. ammonia. The emulsion thus obtained, if cotton oil is present, soon shows a yellowish red color, which becomes more intense after standing for a day. Poppy-rape, sesame oils, and pure lard are not affected.—*A. Bujard and J. Waldbauer, Zeit. Ange. Chemie.*

GUNNER'S ARM REST.

An arm rest for the use of sportsmen and others in shooting offhand is shown in the annexed engraving. The rest is made portable, and when desired for use it is attached to an ordinary cartridge belt and supported by a strap extending over the shoulders.

The rest consists of three principal parts, a sleeve having a clip for engaging a loop on the belt, a ratchet bar sliding in the sleeve, and a U-shaped bar attached to the ratchet bar for receiving the arm of the gunner. The sleeve is provided with a spring bolt which strikes the clip and holds it on the loop of the belt, and it is also provided with a spring key which engages the ratchet bar so as to hold the arm loop at any desired height. In addition to the key, the sleeve is provided with a thumb screw which enters a groove in the back of the ratchet bar and prevents the ratchet bar from turning. It may also be used for clamping the bar, thus affording additional security.

The device may be extended by simply pulling the arm loop upward, but to reduce its length the spring key which engages the ratchet bar must be pressed before the bar can be moved downward. At the upper and lower ends of the ratchet bar there are square notches for receiving the spring key. When the key is in engagement with these notches, the bar is prevented from moving in either direction.

SPROUL'S ARM REST FOR GUNNERS.

By the use of this device the arm is held steadily in an extended position, so that shooting may be done offhand as accurately as when firing over a stationary gun rest. For further particulars about this useful invention, address the patentee, Mr. Robert B. Sproul, or Mr. David S. Dickson, of Quartz, Montana.

ERRATUM.—In Mr. Wyatt's interesting article on phosphates in last issue, the analysis of South Carolina phosphates contained an error. "Phosphates of iron and alumina" should read oxides of iron and alumina.

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The Phosphate Beds of Our Southern States.

BY FRANCIS WYATT, PH.D.

(*Continued from page* 407.)

THE FLORIDA PHOSPHATE DEPOSITS.

While, however, it is a very good thing to find abundant phosphate mines, such mines are of little value without the necessary capital for their exploitation. This capital not being forthcoming in the South, it has followed that our great Northern capitalists and bankers have been lately much attracted by tempting offers to share in the benefits of the discovery. Expert chemists and mining engineers have, therefore, had plenty of work in the "Land of Flowers," and my own examinations as one of these have extended during the last two years over every county on the Gulf of Mexico, from Tallahassee to Punta Gorda.

One of the first difficulties I encountered was the fact that up to date we have no record of a systematic or correct geological or topographical survey of the State. It will, consequently, be of interest to remark that, in its topographical aspect, Florida is low-lying and gently undulating, the highest point being not more than 250 feet, and the average about 80 feet above sea level.

The elevated points or ridges are composed entirely of sand, and are covered with a very luxuriant growth of tall pines. The depressions or valleys, especially when situated along the coast, are composed of a mixture of calcareous marls and sand, from which outcrop, at irregular and frequent intervals, large and small bowlders of limestones, sandstones, and phosphate rock. These valleys are principally known in the country as "hammock land," and are said to be very fertile. When uncultivated, however, they are covered with a dense, wild growth of vegetation, characteristic of the swamp. With the climatic conditions I shall make no attempt to deal, for they are too widely known, but of the geological aspect I may say that the entire State appears to be underlaid, at greatly varying depths, with upper Eocene limestone rock, and I am therefore of the opinion that the first emergence of Florida must be dated from that period.

During the succeeding Miocene submergence there was deposited upon these limestones, more especially in the cracks or fissures resulting from their drying up, a soft, finely disintegrated calcareous sediment or mud.

The gradual evaporation of these Miocene waters brought about the formation, principally in the neighborhood of the rock cavities and fissures, of large and small estuaries. These estuaries were replete, swarming with life and vegetable matter—fish, mollusks, reptiles, and marine plants. They were, besides, heavily charged with gases and acids, and their continuous concentration ultimately induced a multiplicity of readily conceivable processes of decomposition and final metamorphism.

In the estuaries and banks thus formed by the deposition and evaporation, or subsidence, of the Miocene seas we shall find the origin of our phosphate of lime, and, disregarding all other hypotheses, I consider that we are practically contemplating: 1. A foundation of Upper Eocene limestone rocks very much cracked up and fissured, the cracks having a general trend N. E. and S. W. 2. Irregular beds, pockets, or banks of Miocene deposits, dried and hardened by exposure, and alternately calcareous, sandy or marly; generally phosphatic, and sometimes entirely made up of decomposed organic debris, the phosphoric acid being combined with various bases (lime, magnesia, iron, alumina, etc.)

After the disappearance of the Miocene sea, there came some gigantic disturbances of the strata. There were upheavals and depressions. The underlying limestones were probably again split up, and the Miocene deposit was broken and hurled from the surface into yawning gaps, and from one fissure to another.

Now came the Pliocene periods or end of the Tertiary, and then the seas of Quaternary age, with their deposits and drifts of shells, sands, clays, marls, bowlders, and other transported materials, and the accompanying alternate or concurrent influences of cold, heat and pressure.

Taking the whole of these phenomena broadly into consideration, it must be concluded that those portions of the phosphatic Miocene crust which did not fall into permanent limestone fissures or caverns at the time of the disturbance of the strata became at length very thoroughly broken up and disintegrated. They were rolled about and intermixed with sand, clay, and marls, and were deposited with them in various mounds or depressions, in conformity with the violence of the waters, or with the uneven structure of the surface to which they were transported.

Occasionally this drifting mass found its way into very low-lying portions of the country, say into those regions where considerable depression was brought about by the sinking and settling of the recently disturbed mass. At other times it was rolled to and deposited on slightly higher points. In the first of these cases we find a vast and complete agglomeration, comparable to an immense pocket, of broken-up phosphate rock, finely divided phosphate debris, sands, clays, and marls, all heterogeneously mixed in together. In the second case, we find the phosphate in large bowlders, sometimes weighing several tons and intermixed with but relatively small proportions of any foreign substances.

Considering these facts, I form the opinion that the feature in the Florida deposits of phosphate to be most particularly brought out is that the formation consists essentially of: 1. Original pockets or cavities in the limestone filled with hard and soft rock phosphates and *debris*. 2. Mounds or beaches, rolled up on the elevated points, and chiefly consisting of huge bowlders of phosphate rock. 3. Drift or disintegrated rock, covering immense areas, chiefly in Polk and De Soto Counties, and underlying Peace River and its tributaries.

At the present time the work of exploration or prospecting may be said to have extended all over the State in each of these varieties of the formation. Actual exploitation on the large scale by regular mining and hydraulic methods has been commenced at various points, and a very careful study of these workings has confirmed me in the theories I have just formulated.

In one of the mines, in Marion County, for example, there is an immense deposit of phosphatic material, proved, by actual experimental work, to extend over an area of several acres. It has shown itself to be a combination of the "original pocket" and the "mound" formation, and the superincumbent material, principally sand and marls, has an average depth of about 10 feet. The phosphate immediately underlies it, sometimes in the form of enormous bowlders of hard rock, cemented together with clay, sometimes in that of a white, plastic, or friable substance resembling kaolin, and probably produced by the natural disintegration of the hard rock by rolling, attrition, or concussion. The actual thickness of the entire bed is still somewhat uncertain, but the depth of the quarries is not more than 50 feet, and yet a little over two acres of the land have already yielded more than 20,000 tons of good ore, without signs of exhaustion.

Directly outside the limits of these quarries the "pockety" and "mound" formations seem to abruptly terminate, and the deposit assumes, over a wide area, the form of an unimportant drift, which sometimes crops out at the surface, and which has been followed in all directions over the immediate vicinity without leading to another pocket of similar value.

Identical geological phenomena being prevalent in nearly every section of the country, I consider myself warranted in declaring that the Florida land phosphates of high grade occur in beds of an essentially pockety, extremely capricious, uneven, and deceptive nature.

Sometimes the pockets will develop into enormous quarries, and will probably yield fabulous quantities of various merchantable qualities. At other times they will be entirely superficial, or will contain the phosphate in such a mixed condition as to render profitable exploitation impossible.

This capriciousness or uncertainty will be somewhat less in the case of the "pebble" or drift deposits, since they have been proved to exist at various depths and in varying thicknesses, with comparative regularity over a very extensive area.

The actual chief working center for this variety is Peace River, which rises in the high lake lands of Polk County and flows rapidly southward into the Gulf of Mexico. Its course is extremely irregular, and its bottom is a constant succession of shallows and deep basins.

Lakes Tsala, Opopka and Chillocohatchee, and Paines and Whidden creeks are its chief tributaries and the main sources of its phosphate deposits; the pebbles being washed out from their banks and borne along their beds by the torrential summer rains.

The exploitation of the pebbles is performed by means of a 10 inch centrifugal steam suction pump placed upon a barge. The pipe of the pump, having been adjusted by ropes and pulleys, is plunged ahead from the deck into the water. The mixture of sand and phosphate sucked up by it is brought into revolving screens of varying degrees of fineness, whence the sand is washed back into the river. The cleaned pebbles are discharged from the screens into scows and floated down to the "works," where, after being dried by hot air, they are once more screened and are then ready for market. The total cost of raising, washing, drying, screening and loading on the cars is one dollar and seventy-five cents.

Four or five companies are actively working on this plan, and several more are preparing to enter the field.

The pebbles, when freed from impurities and dried, are of a dark blue color, and are hard and smooth, varying in size from a grain of rice to about one inch in diameter. Their origin is proved by the microscope to be entirely organic, and they are intimately mixed up with the bones and teeth of numerous extinct species of animals, birds and fish.

These river deposits all proceed from the banks of sand and debris to which I have alluded as "drift," and which are situated on the higher lands in Polk County. Lakeland and Bartow may be taken as the central points of the dried-out deposits, the pebbles being of the same size, but of a lighter color. They are embedded in a matrix of sand and clay, in which they form the proportion of about 20 per cent in weight of the mass. The thickness of the deposit is exceedingly uneven; in some places it reaches 20 feet, while in others it dwindles down to a few inches.

As would be expected in this species of formation, the chemical composition of Florida phosphate is far from regular. In some regions perfectly white, in others blue, yellow or brown, it is in many instances practically free from iron and alumina, while at others it is heavily loaded with these commercially objectionable constituents. A large proportion of the land rock is very soft when damp, but becomes so hard when dried that it has long been used by the natives, ignorant of its other values, as a foundation or building stone.

The following averages are selected with care from the results of several hundreds of complete analyses made either by myself or by my assistants in Florida and New York. The samples in every case were taken from the exploratory pits in all the different counties and marked before leaving the ground with full details of their origin.

They have been classed as bowlders of hard rock phosphate, or cleaned, high grade material; bowlders and *debris*, or unselected material, merely freed from dirt; soft white phosphate, in which no bowlders are found; pebble phosphate from Peace River, as sent to market; pebble phosphate from Polk County drift beds, washed and screened.

	Phosphate of lime.	Oxides of iron and alumina.	Silica and silicates.	Carbonic acid.
Bowlders (carefully selected, 120 samples).	80·49	2·25	4·20	2·10
Bowlders and debris (237 samples).....	74·90	4·19	9·25	1·90
Soft white phosphate (148 samples)	65·15	9·20	5·47	4·27
Pebble from Peace River (84 samples)...	61 75	2·90	14·20	3·60
Pebble from drift beds, Polk Co. (92 samples)	67·25	3·00	10·40	1·70

I have now written enough to show that the point of most importance in the working of Florida phosphates, especially of the land deposits, will be the careful selection, by conscientious and capable superintendents, of the different qualities at the quarries. There being no present market for the highest grade in this country, it will all have to be shipped to Europe. The rock will, therefore, require to be crushed to a uniform size, to facilitate sampling, and then well washed and thoroughly dried, in order that all the iron and alumina so indiscriminately and unequally mixed up with it in the form of clay may be practically eliminated before shipment.

The maximum limit accepted by European buyers is 3 per cent, and nothing but experience in actual work, daily guided and controlled by the results of chemical analysis, can be relied upon to keep the material within these bounds. Even the most accomplished expert who examines the beds for the first time, and without a full knowledge of the variability of their composition in regard to this iron and alumina, would be sure to go wrong and commit the most fatal blunders. There can be no doubt that Florida is the theater of a big "boom," and that it is passing through a critical period of its history. Fertilizer manufacturers from all over the world are hurrying toward its sandy plains, in the hope of acquiring its phosphatic treasures. They find these scattered in all directions, as well in the rivers as in the lands, and so embarassingly variable in grade that they are brought to a halt by the questions: Where are the "bonanzas"? How are they to be found?

My own opinion of her phosphate mining, as will have been gathered from my remarks, is that it will prove extremely profitable to those who purchase and work its fields with judgment; but that it will certainly turn out in the highest degree disastrous to such as allow themselves to be led away by excited first impressions. The interior is still practically unsettled, and traveling is attended by the greatest difficulties and inconveniences. The negro labor is far from plentiful; there are few wagon roads suitable for transportation purposes; and the railroad facilities are altogether inadequate, the companies being poorly provided with freight cars. Under these circumstances, the natural difficulties or impediments to Florida phosphates are at present rather discouraging, and it is only when these have been cleared away, by the gradual development of the State, that the ores of all grades will begin to come forward in large quantities.

Their average richness in phosphoric acid is, on the whole, very satisfactory, though somewhat less than we were led to expect by the first reports, and a large proportion of the output will compare favorably with many other phosphates extremely popular with fertilizer manufacturers. Although more than a hundred companies have been already formed, with an aggregate capital of some $30,000,000 only 20,000

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tons have yet been shipped to European ports. The bulk of this has, however, found a ready market at good prices, and it is quite certain that when speculation gives way to legitimate work, the constanly increasing demand will make of Florida the largest contributor to the world's supply.

DRAWING OF FINANCIAL BILLS BY THE CASANOVA APPARATUS.

The system of paying loans by obligations redeemable in a certain number of days through drawing lots has been greatly developed in our day, and is tending to increase to a still further degree. Some of these loans, those of the city of Paris, for example, are redeemable in a period of ninety-nine years; while others, such as the bonds issued on the occasion of the Universal Exposition of 1889, have fixed for such redemption a period of only seventy-five years. In certain cases, the obligation, issued generally at 500 francs, or at a slightly smaller figure, will be redeemable at 1,000 francs, and, in other cases, at its face value. Again, these annual drawings often include the distribution of prizes of more or less value, and which sometimes reach the respectable figure of 50,000, 100,000, and even 500,000 francs.

The simple *expose* that we have just given authorizes us now to claim that the operations that are to concur in the preparation and definitive establishment of the system of drawing such values, to which fate (sometimes ungrateful) may reserve a fortune under the form of a large prize, should be surrounded with the minutest and most mathematical precautions. Let a single one of the innumerable numbers (sometimes more than a million, as in the drawing of the prizes of the exposition bonds, which were 1,200,000 in number) be forgotten, and let the public by any means be apprised of the error, and we shall see our drawing exposed to just and very disquieting demands. Who knows whether or not the blind wheel of fortune stopped before the unfortunate forgotten number?

Were it a question of a simple lottery, there would be less trouble. A hidden sin is half pardoned; in this case it would be entirely so. In fact, the lottery differs from the drawing of redeemable bills in that, for the latter, the entire series of numbers, representing the corresponding subscribed obligations, must have made their exit from the wheel that contains them in a given period. If, for example, five hundred obligations are redeemed annually, the wheel will still have to contain, from the time of the last drawing, five hundred numbers, and not four hundred and ninety-nine, or even less. If the five hundred numbers are not presented to be called off, with entire accuracy, the putting of the numbers in the wheel has been imperfectly done in the beginning, or else former drawings have been incorrectly executed. In a word, there have been numbers forgotten or mislaid—forgotten at the moment of filling the wheel, or lost at the time of the annual drawings. There is no way out of this dilemma. On both hands, the operation will have been faulty, to the highest degree, and every bearer of a thrown-out obligation will have the right to render legally responsible for it the society, city or state that has assumed the reponsibility for it before its bond holders.

We frankly admit that we were never aware of the many inconveniences that we have just detailed until we had an opportunity of being present at a drawing—say at the putting of the tickets in the wheel, and at their extraction from their happy domicile. An opportunity of observing these curious operations was offered to us last year at the time of the fete that the Parisian press gave at the Continental Hotel for the benefit of a relief fund for widows and orphans. Aside from the fete itself, concert, ball, and exhibition we had got up a lottery of 15,000 tickets winning 587 different prizes. The drawing of these 587 prizes was done on March 15, in the presence of three delegates, Messrs. Victor and Henry Simond and Mr. Ranc. The putting of the numbers in the wheel had been effected on the previous evening by means of the Casanova apparatus, which we represent herewith. Everything proceeded wonderfully well, and Mr. Casanova had nothing to do but receive the best wishes of our *confreres*. As the press lottery was but a tombola, the 14,413 numbers remaining in the wheel were destroyed.

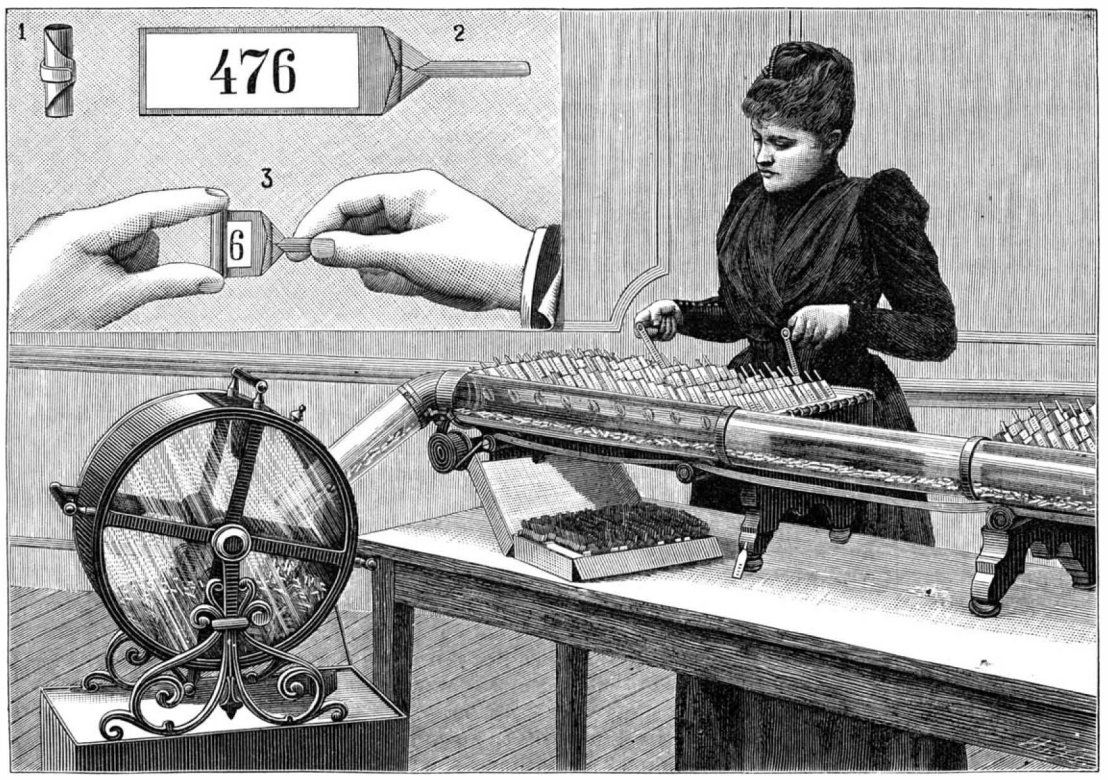

Fig. 1.—PUTTING THE NUMBERS OF A DRAWING INTO THE WHEEL, BY MEANS OF THE CASANOVA APPARATUS. 1. The number rolled up. 2. The number open. 3. The unrolling of the number.

Let us dwell in detail upon this wheel that we have just alluded to. It may be seen to the left of Fig. 1. It is about twenty-four inches in diameter. The two ends of it are of plate glass, that allow the numbers that it contains to be seen. The periphery of the wheel is of copper. Four handles permit of maneuvering it and of making it revolve in order to mix up the numbers, the dispersion of which is still further hastened by metal fans arranged within for this purpose.

The aperture that serves for the introduction of the numbers, and that will permit later on of taking them out at the epoch of the annual drawings, is, of course, carefully sealed after the numbers have been inserted and every time the effective numbers have been removed. The wheel is provided with two, or even three, locks, several keys to which are placed in the custody of those appointed to preside at the drawing.

Before everything else, then, it will be this wheel that it will be necessary to look after with the strictest attention. In the first place, not a number more, not a number less, between its glass ends. One more, that is difficult; one less, that has been seen. However this may be, absolute exactitude in the method of filling the wheel is necessary before all else. That is not all yet. Other misfortunes may happen. For example, at the time of a drawing, a delicate hand has been seen to enter the wheel, and draw two numbers therefrom. Two, be it understood, instead of one. The two unfortunate numbers, one of which might have been the winner, had got stuck together through their roughness, and were taken out as one. Which is to be put back into the wheel? Which shall be sacrificed when it has been so near the fortune? Solomon himself would have been perplexed—especially had he been the owner of several obligations, or even of but a single one! Along with exactitude in filling the wheel, it will be necessary to see also that the number itself be of intelligent and irreproachable make, and so established that it shall be irremissibly isolated from its neighbor, rolled artistically, with the figure perfectly legible and firmly glued. In a word, in the primitive operation, as well as in the annual operations, it is necessary to avoid every chance of irregularity and complaint.

We can now examine Mr. Casanova's system at our ease. In the first place, as to the number itself: This is admirably gotten up, and in such a way as not to be exposed to various inconveniences, and particularly to the inconvenience of bunching that we mentioned above. It is formed of a very light sheet of brass one and a half inches in length and a little over one-tenth of an inch in width, to which adheres a very light piece of linen carrying the figures, and which terminates in a small brass rod, which later on will be rolled around the sheet. The figures 1, 2, 3 in the corner of Fig. 1 show the number; unrolled completely at 2, and wholly rolled up at 1, as it is in the wheel.

At 3 the operator is unrolling the brass cylinder after its extraction from the wheel.

Now as to fitting the wheel. Let us refer for this to Fig. 1. Let us follow attentively the operations that are to carry the mechanically rolled numbers from the boxes in which they are primarily placed up to the wheel, in passing through the glass cylinder which we see in the foreground. The numbers, wholly open, are classified in advance by fifties, in boxes. As the apparatus consists of absolutely identical machines, each serving to put one hundred numbers in the wheel, we shall examine but one of them.

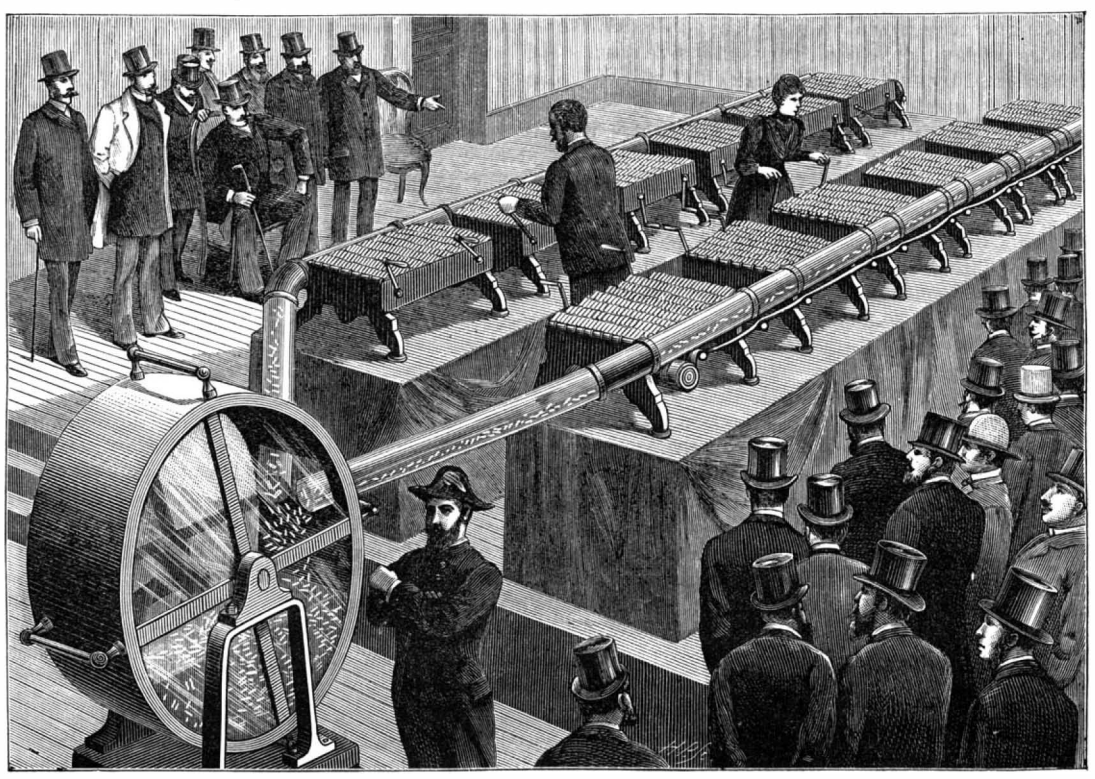

Fig. 2.—GENERAL VIEW OF THE PUTTING OF THE NUMBERS OF A DRAWING INTO THE WHEEL BY MEANS OF TWELVE CASANOVA APPARATUS OPERATING SIMULTANEOUSLY.

The operator, who has within reach the box of numbers to be put into the wheel, stands in front of a rectangular box, divided into ten equal parts by ten steel rods split lengthwise, and equidistant from each other.

In the longitudinal slit in the rods, the operator fixes the metallic numbers, ten to a rod—say a hundred numbers to ten rods. Fig. 1 represents the phase of the operation in which these hundred numbers are thus stuck in the slit in the rods, the brass tail of the number being upward.

So much for the placing of the tickets. At this moment, an examiner sees to it that these hundred tickets are complete in their place, that not a single one of them is missing, and that they belong to the same hundred series. He can read them, or ask the operator to point out to him or even to deliver to him any number of the hundred. Briefly, the minutest verification is at his disposal, and no chance exists of seeing a number doubled or absent or blank.

Second operation: the rolling of the numbers. As each of the ten rods that carry the numbers is movable around its axis, it is capable, through a winch within reach of the operator, of making as many re-

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volutions as may be desired. One revolution of the winch, then, or rather several revolutions (the operator is here represented as about beginning the rolling), and the numbers, but just now flat and vertical, are rapidly wound around rods. Of course, a single winch causes the simultaneous revolution of the ten rods. At this instant again the examiner can come to find whether each rod carries its ten rolled numbers properly, whether the hundred is therefore complete, and to see that none of the numbers of this series (it will be the same with all the others) is missing from the wheel.

Third operation: The guidance of the rolled numbers into the wheel. A few revolutions of a second winch actuate a flat rod placed in the rectangular box, and the forward motion of which pushes the hundred numbers, which thus fall through apertures in front of each of the rods that support them, into the glass tube that runs along the various machines. The bottom of this glass tube is provided with a belt upon which rest the numbers thrust forward by the rods. This belt is endless, and passes and repasses, through a pulley shown to the left of the figure, in the interior of the cylinder, and thus carries the rolled numbers to the oblique glass tube, which empties them into the wheel.

The description of the filling of the wheel just given is sufficiently detailed to allow the reader to get an idea of the exactitude and of the minuteness of the operations which secure indisputable regularity in a future drawing. The drawing of the press lottery mentioned above was, however, but an elementary operation alongside of the putting in the wheel of the 1,200,000 numbers of the exposition bonds that Mr. Casanova executed in 1889 for the account of the Credit Foncier. For this colossal operation it was necessary to use a wheel 4¼ feet in diameter, in which, in ten days, were placed the million and more brass cylinders, by means of the twelve machines represented in Fig. 2.—*La Nature.*

Electric Light Fishing.

The sloop Lou left San Diego, June 4, on a novel fishing expedition, to last from one to three months, so says the *Pacific Lumberman.* An electric plant has been put on board, and the fishing is to be done by the aid of incandescent lights and a net. Experiments in the bay proved that everything alive under the water is attracted by the glare of the light, and thousands of fish of every description can be taken in a short time and with very little trouble.

Four men were on board, and the boat has steered for the banks near San Clemente Island. The practical result of the first voyage will be watched with much interest, and if it is as successful in deep water as the experiments in the bay have been, the projectors of the enterprise are confident they will have solved the problem of supplying all Southern California with cheap fish. W. G. Riffenberg, a citizen of San Diego, is the inventor of the apparatus.

The Right to Use Ground Wires.

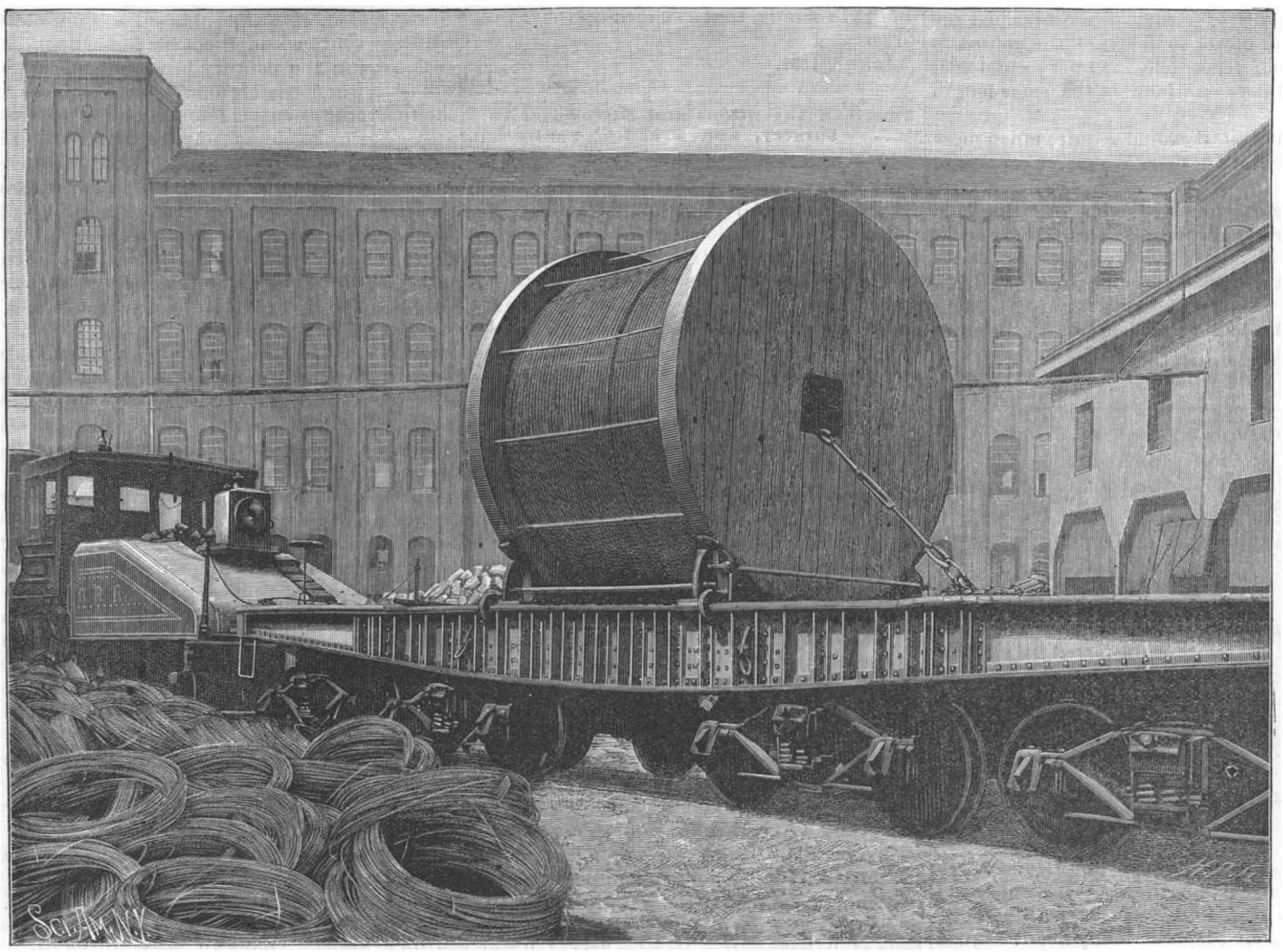
The Supreme Court of Ohio has rendered a decision reversing the decision of the lower court in the case of the Cincinnati Inclined Plane Railroad Co. against the City and Suburban Telegraph Co. Action was brought by the telegraph and telephone companies to enjoin the Inclined R.R. from operating its line by the Sprague system (single trolley method), on the ground that by its use the telephone system was rendered practically useless. The telephone people claimed a prior right to the use of the earth as a means of securing a return circuit. The court upholds the theory that the street is primarily intended for the use of the public for traveling and transporting goods, and practically that if the motive power employed for this primary use interferes with a secondary use, the law cannot help it. It has been said that this decision makes free property of the earth as a conductor—that is, that the company using the most powerful current may crowd out smaller concerns by sheer superior power; but it is more accurately described as above indicated—as holding a railroad more important than a telegraph or telephone.

GREAT SPOOLS OF WIRE.

The extensive use of street cable railways has necessitated the manufacture of wire ropes of great continuous length, and the problem of transporting such ropes, without injury, from the manufactory to the place of use, was a serious one.

This was successfully solved by Messrs. John A. Roebling & Co., of Trenton, N. J., whose cable railway ropes have become everywhere famous for excellence.

A single Roebling cable sometimes is required to have a length of 6½ miles. Such a rope 1¼ in. in diameter will weigh 42 tons. It is reeled upon a single spool, over 10 ft. high, as shown in our engraving, which is from a photograph. A special car of superior strength receives the great package. The particular rope here shown was made for the Western Company's cable railway, St. Louis.



SHIPMENT OF STREET RAILWAY CABLES.

Wood for the Printing Press.

The wool pulp business is generally regarded as in its infancy in this country, and yet the product is enormous. The Philadelphia, Pa., *Record*, which makes its own paper, has furnished a piece of special information, which gives an inkling of the magnitude of the general consumption of wood pulp. It states that a single edition of the *Record*—150,000 copies of a 12 page paper—required 17 tons of blank paper, to produce which 67 cords of poplar was used. In 22 hours from the time of felling the tree it had been turned into printed papers. The process is thus divided with respect to a test case: Chopping 1½ cords of wood, 3 hours; in manufacturing into pulp, 12 hours; transporting to the *Record* office, 1 hour and 20 minutes; wetting paper preparatory to printing, 30 minutes; printing 10,000 copies, 10 minutes. This shows the rapidity with which raw material may be turned into a finished article, going through numerous processes. If the *Record* averaged 50 cords of poplar daily, it would amount to 18,250 cords annually. It must then be considered that this is only one paper in one city, and that about every newspaper is printed from material consisting largely, and often almost wholly, of wood pulp, which is also used in the production of nearly all common and medium grades of paper for almost all uses. It is thus seen that the consumption of wood in pulp making is of great magnitude.

With the enormous consumption of wood for railway ties and building and the added requirements of the printing press, it is not strange that our forests are rapidly disappearing. Every State should pass laws for the encouragement of tree planting. If steps are not soon taken to restore our woods, there will ere long be a tree famine.

Twelve-Inch Gun No. 1.

The first 12-inch steel gun made in the United States has been completed at the Watervliet Arsenal, West Troy, N. Y., and shipped to the Sandy Hook proving ground for testing. This is the largest steel gun ever built in this country, and is the first of 16 of its type ordered by the government. It has been building since 1888, and great things are expected of it. It is designed for seacoast defense, with the 12-inch steel mortars that are also now being built. The gun weighs 52 tons. It is 36·66 feet long and the length of the bore is 34 feet. Its charge is 440 pounds of powder, and its projectile weighs 1,000 pounds. The powder pressure that will be exerted on its interior when the gun is fired is 16·5 tons to the square inch. The initial velocity of the projectile will be 1,940 feet per second, the muzzle energy 26,000 foot tons. At the muzzle this projectile will penetrate 32 inches of iron, and at a distance of two miles 20 inches.

The tube and jacket forgings for this gun were purchased at Le Creusot, France, and the remaining forgings were obtained from the Midvale (Penn.) Steel Works. Although it was necessary to go abroad to purchase the largest forgings, owing to the fact that substantial progress in the manufacture of steel forgings in this country had not then been made, it will not be necessary to do so in the future, American manufacturers having in the meantime acquired an experience that enables them to produce the largest forgings. The completion of this gun marks a creditable step in the progress that the government is making in its army gun factory at the Watervliet arsenal.

IN the early days of steamships on the Atlantic the steam pressure carried was five pounds only above the atmosphere, and the engines made from 10 to 12 revolutions per minute; the vessels made 8 knots per hour on an average. Now we carry exactly 36 times the pressure, make 7 times the revolutions, but go only 2½ times faster.

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Correspondence.

Lead Pierced by Insects.

To the Editor of the Scientific American:

Referring to the article in your issue of this date, under head "Lead Pipe Pierced by an Insect," I have in my possession a lead bullet, that I cut out of the tree under which Grant and Pemberton arranged for the surrender of Vicksburg, Miss. The bullet was lodged just under the bark in the sappy portion of the tree, and has three holes pierced through it by some kind of an insect. One of the holes contained one of these insects at the time I secured the bullet.

These facts can be substantiated by two witnesses now living. WM. E. SELLECK.

Chicago, June 13, 1891.

The Law of Friction.

To the Editor of the Scientific American:

I notice in a recent issue of your valued journal an article headed "Phenomenal Friction," and after a careful reading I fail to see anything "phenomenal" about it. It only demonstrates the common law of friction in relation to motion, *i. e.*, if it takes a certain number of foot pounds to cause the axle to revolve against the surface of its box a certain number of inches per second, and you wish to increase that motion one inch per second, you will discover that it requires just the same expenditure of power to increase the motion in relation to its circumference one inch per second as it does to move it endways one inch in the same length of time.

If the axle were at rest, it would require much more power to move it, because there is a closer contact of surfaces.

When motion begins, the axle begins to "ride" on the oil, or whatever substance there is to prevent contact.

If I wish to insert a close-fitting plug, I do so with a twisting motion if possible, because I have a lever advantage, and I also lessen the contact, by the additional circular motion. D. C. GREEN.

Bellefontaine, O., June 9, 1891.

The Cosmical Telephone.

To the Editor of the Scientific American:

As to the possibilities of the cosmical telephone referred to in the SCIENTIFIC AMERICAN of June 20, by means of which the inventor hopes to hear sounds resulting from solar causes, it may be said that it is pretty well established that sound cannot travel without a medium, either solid, liquid or gaseous. So far as is known there is no medium between the earth and the sun beyond the limits of the terrestrial shallow atmosphere capable of transmitting sound waves, and until it is shown that such medium exists, the theory of inter-solar transmission of sound will not find ready acceptance among physicists. The strange sounds heard by Mr. Edison, as he states, while experimenting with the long distance telephone, if cosmical at all, were, it would seem, much more likely to have been of seismic origin.

Furthermore, judging by present knowledge as to the rate of sound transmission, there was no connection between the sounds heard and the observed sun spots, for if Mr. Edison, as he suspects, really heard sounds from the sun, the cause that produced them must have taken place more than thirteen years before they reached the earth, unless it be proved that sound may be transmitted by radiant electricity or some other equally rapid agent. That Mr. Edison's experiments may result in important discovery is much to be hoped, but at present it seems hardly probable that he will be able to hear the roar and crash of solar tempests, as inviting as the thought may be. E. B. WHITMORE.

Rochester, N. Y., June 22, 1891.

Jet Propulsion.

To the Editor of the Scientific American:

Thinking that an original idea had come to me, I recently made some investigations relative to the use of air to act as a sort of lubricant between the water and hull of a steamship, and thus increase the speed of a vessel, or lessen the power necessary to propel it. As usual, I found this thing had been gone over years ago, at least so far as patenting the scheme was concerned. It was a mere chance, however, that this old patent was unearthed by the examiner, for it had been indexed under the head of jet propulsion.

It is quite disappointing to have a pet scheme blasted in this way, and besides be told by the best of authority that air is the very thing they are trying to get rid of. Former experiences made disappointment bearable.

As jet propulsion is receiving some attention of late, I would like to add a word on this subject. Of course, the popular verdict of engineers is against the jet method, for patents have been granted both in England and America, and various methods tried. Yet this does not prove that the principle is wrong, or may not yet be made a success.

Although a backwoodsman and poorly qualified to judge of such things, still I would venture to suggest that in order to make the jet effective a large volume of water must be handled and thrust with a relatively low pressure and velocity against that which is to resist its motion. It requires but little calculation to show that the pressure, per square inch, on the paddles of a steamboat wheel is slight, in most cases not more than from two to four pounds. The buckets are moved at a velocity of 30 to 50 feet per second, or only a little more than double the speed of the boat. With these figures as foot-pounds, it is plainly seen that a large volume of water must be moved under like pressure and speed in order that the power may be absorbed which is used for steamship propulsion.

Again, the idea suggests itself, may not the jet water enter at the bow and discharge both at the sides and stern, thus producing a suction at the bow where it may be useful, and preventing it at the stern where hurtful?

I predict that some persistent inventor will hit on the right thing some of these days, great as may seem the innovation on present methods. To have suggested the abolishment of the methods of flour making, as practiced from time immemorial, a few years ago, would have been equally absurd.

Let the jet principle be right or wrong, we are in sympathy with it, and believe that eventually single and twin screws, that so churn up the ocean, will have to go. QUIRK.

June 5, 1891.

American Inventions and Discoveries in Medicine, Surgery, and Practical Sanitation.*

In connection with this celebration of a century's work of the American patent system, I have been requested by the Advisory Committee to prepare a brief paper upon inventions and discoveries in medicine, surgery, and practical sanitation, with special reference to the progress that has been made in this country in these branches of science and art. It would be impossible to present on this occasion such a summary as would be of any special interest or use of the progress which has been made in medicine and sanitation during the century, either by the world at large or by American physicians and sanitarians in particular; and I shall therefore confine my remarks mainly to the progress which has been made in these branches in connection with mechanical inventions and new chemical combinations, devised by American inventors, which will require much less time.

The application of the patent system to medicine in this country has had its advantages for certain people, has given employment to a considerable amount of capital in production (and to a much larger amount in advertising), has contributed materially to the revenues of the government, and has made a great deal of work for the medical profession.

So far as I know, but one complete system of medicine has been patented in this country, and that was the steam, Cayenne pepper, and lobelia system—commonly known as Thomsonianism—to which a patent was granted in 1836. The right to practice this system, with a book describing the methods, was sold by the patentee for twenty dollars, and perhaps some of you may have some reminiscences of it connected with your boyish days. I am certain I shall never forget the effects of "Composition Powder," or of "Number Six," which was essentially a concentrated tincture of Cayenne pepper, and one dose of which was enough to make a boy willing to go to school for a month.

From a report made by the Commissioner of Patents in 1849, it appears that eighty-six patents for medicines had been granted to that date; for the specifications of most of those issued before 1836 had been lost by fire. The greater number of patents for medicines were issued between 1850 and 1860. The total number of patents granted for medicines during the last decade (1880–1890) is 540. This, however, applies only to "patent medicines," properly so called, the claims for which are, for the most part, presented by simple-minded men who know very little of the ways of the world. A patent requires a full and unreserved disclosure of the recipe, and the mode of compounding the same, for the public benefit when the term of the patent shall have expired; and the Commissioner of Patents may, if he chooses, require the applicant to furnish specimens of the composition and of its ingredients, sufficient in quantity for the purpose of experiment. The law, however, does not require the applicant to furnish patients to be experimented on, and this may be the reason why the Commissioner has never demanded samples of the ingredients. By far the greater number of the owners of panaceas and nostrums are too shrewd to thus publish their secrets, for they can attain their purpose much better under the law for registering trade marks and labels, designs for bottles and packages, and copyrights of printed matter, which are less costly, and do not reveal the arcanum. These proprietary medicines constitute the great bulk of what the public call "patent medicines."

The trade in patent and secret remedies has been, and still is, an important one. We are a bitters and pill-taking people; in the fried pork and saleratus biscuit regions the demand for such medicines is unfailing, but everywhere they are found. I suppose the chief consumption of them is by women and children—with a fair allowance of clergymen, if we may judge from the printed testimonials. I sampled a good many of them myself when I was a boy. Of course these remarks do not apply to bitters. One of the latest patents is for a device to wash pills rapidly down the throat.

I am sorry to say that I have been unable to obtain definite information as to the direct benefits which inventions of this kind have conferred on the public in the way of cure of disease or preventing death. Among the questions which were not put in the schedules of the last census were the following, namely: Did you ever take any patent or proprietary medicine? If so, what and how much, and what was the result? Some very remarkable statistics would no doubt have been obtained had this inquiry been made. I can only say that I know of but four secret remedies which have been really valuable additions to the resources of practical medicine, and the composition of all these is now known. These four are all powerful and dangerous, and should only be used on the advice of a skilled physician.

I said in the beginning that I cannot, on this occasion, give any sufficient account of the progress of invention and discovery in medicine and sanitation during the century just gone. The great step forward which has been made has been the establishment of a true scientific foundation for the art upon the discoveries made in physics, chemistry and biology. One hundred years ago the practice of medicine, and measures to preserve health, so far as these were really efficacious, were in the main empirical—that is, certain effects were known to usually follow the giving of certain drugs, or the application of certain measures, but why or how these effects were produced was unknown. They sailed then by dead reckoning, in several senses of this phrase.

Since then, not only have great advances been made by a continuance of these empirical measures in treatment, but we have learned much as to the mechanism and functions of different parts of the body, and as to the nature of the cause of some of the most prevalent and fatal forms of disease; and, as a consequence, can apply means of prevention or treatment in a much more direct and definite way than was formerly the case. For example, a hundred years ago nothing was known of the difference between typhus and typhoid fevers. We have now discovered that the first is a disease propagated largely by aerial contagion and induced or aggravated by overcrowding, the preventive means being isolation, light, and fresh air; while the second is due to a minute vegetable organism, a bacillus, and is propagated mainly by contaminated water, milk, food, and clothing; and that the treatment of the two diseases should be very different.

The most important improvements in practical medicine made in the United States have been chiefly in surgery in its various branches. We have led the way in the ligation of some of the larger arteries, in the removal of abdominal tumors, in the treatment of diseases and injuries peculiar to women, in the treatment of spinal affections, and of the deformities of various kinds. Above all, we were the first to show the use of anæsthetics—the most important advance in medicine made during the century. In our late war we taught Europe how to build, organize, and manage military hospitals; and we formed the best museum in existence illustrating modern military medicine and surgery.

As regards preventive public medicine and sanitation, we have not made so many valuable contributions to the world's stock of knowledge, chiefly because, until quite recently, we have not had the stimulus to persistent effort which comes from density of population and its complicated relations to sewage disposal and water supplies; nor have we had information relative to localized causes of diseases and death which is the essential foundation of public hygiene, and which can only be obtained by a proper system of vital statistics. We can, however, show enough and to spare of inventions in the way of sanitary appliances, fixtures, and systems for house drainage, sewerage, etc.; for the ingenuity of inventors has kept pace with the increasing demands for protection from the effects of the decomposition of waste matters, as increase of knowledge has made these known to us. The total number of patents granted for sanitary appliances during the last decade (1880–1890) is about 1,175.

No doubt the greatest progress in medical science during the next few years will be in the direction of prevention, and to this end mechanical and chemical invention and discovery must go hand in hand with increase in biological and medical knowledge. Neither can afford to neglect or despise the other, and both are working for the common good. If the American patent system has not given rise to any specially valuable inventions in practical medicine or in theology, it must be due to the nature of the subjects, and not to fault of the system.

*By Dr. John S. Billings, U. S. A. Abridged from Boston *Medical and Surgical Journal* by *Popular Science News*.

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RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM BOILER FURNACE. — Michael E. Herbert, St. Joseph, Mo. This invention provides a fire box divided into two compartments by a water leg, water legs also forming the sides of the fire box, a feeding grate being adapted to carry the fuel from one compartment to another, and passages surrounding the fire box for conducting the smoke and gases to be consumed. The furnace is designed to afford great heat capacity and economy in the consumption of fuel, while being adapted for use with an ordinary tubular or other type of boiler, being also easy of operation and substantial in construction.

VALVE GEAR. — Albert M. Sykes, Philadelphia, Pa. This is new and simple form of valve gear to take the place of the ordinary link motion in locomotives and stationary engines for the purpose of reversing the stroke. It consists of a cross head carrying an actuating plate, a pair of reversely arranged cam arms pivoted at one end and maintained alternately in position to be acted upon by the plate; with means for transmitting the motion of the cam arms to the valve.

SAFE STEAMBOATS. — Joseph B. Brolaski, St. Louis, Mo. Several patents have been granted this inventor covering the construction in steamboats of light weight compartment doors and bulkheads in the hull and light weight corrugated metal cabins and deck houses. Also a simple steam steering apparatus without auxiliary engines and one for short chimneys with long natural draught. This inventor has also secured from other patentees four several valuable improvements for water craft. The compartment bulkheads are designed as a most efficient protection against sinking. The combination of these devices is to secure a boat that will not sink, will not burn up, will steer quickly and hold steadily, use less fuel, and give more speed with less strain and lighter draught, and will be a good boat. She should also insure for a very low rate and be a safe, serviceable and economical steamboat for an average lifetime. The special safeguards stated are simple, of little cost apparently, and are said to be applicable to the present style of boats to make them safer and enhance their value.

Railway Appliances.

CAR COUPLING. — Hamlin G. Russell, Lincoln, Ill. This invention provides a means whereby the drawheads may be united by a yielding adjustable connection, and also provides springs in connection with the drawbars capable of performing the double functions of draw and buffer springs. The construction is simple and durable, while the coupler is capable of automatic coupling action, and of being conveniently and expeditiously uncoupled from the top or the sides of the car.

Electrical.

APPARATUS FOR TREATING DEAFNESS.—George F. Webb, Jefferson, Ohio. This apparatus comprises a battery, a belt, an electrode supported on the belt and shaped to rest upon the ear, and having an opening in one side to receive the ear, and connections between the electrodes and the battery. The invention provides a simple and efficient device for constant use to remove the source of deafness, one which may be easily applied, and is designed, while serving as a remedy, to enable the patient to hear distinctly.

Mechanical Appliances.

ROOFING SEAMER.—Orren P. Talley, Richmond, N. C. This is a device for forming the seams in joining metal roofing, and is designed to quickly and positively join the ends of the sheets and form a complete crimp at each operation of the machine. Its construction is such as to avoid the danger of breaking or cracking the ends of the tin as it is crimped, while it is also adapted for turning a double seam, being at the same time a practical and easily manipulated device which can be manufactured at a small cost and is not liable to get out of order.

BRUSH FOR LITHOGRAPHERS.—Gustav Arnold, Brooklyn, N. Y. This is a brush for stipple work, in which the body is swiveled to the handle, the body being of a yielding or elastic material, as of rubber or its equivalent, and tapered in the direction of one end, while having its exterior surface or technic provided with a series of teats. It is so designed that with this brush an artist may readily produce a stipple surface of a strong, light, or intermediate tint, quickly and in an artistic manner, the brush being capable of manipulation in a like manner to one employed in painting.

Agricultural.

PLANTER.—John A. Handeland, Jackson County, Minn. (Lake Park P. O., Dickinson County, Iowa.) This is an implement designed especially for garden use, and so constructed that it may be utilized for planting seed or for cultivating young plants, and when the planting mechanism is removed the implement may be employed as a wheelbarrow. The implement is light and of durable construction, and capable of convenient manipulation, the invention embodying various novel features and combinations of parts.

CATTLE RACK. — James H. Howard, Baldwin, Kansas. Combined with a series of posts arranged in rows and rails detachably attached to the posts, are separate independent panels containing feed openings and adjustably attached to the rails, with other novel features, forming a means whereby cattle may be fed from stacks of hay or other food in the field without wasting the food, and without danger of the stack falling upon the cattle.

FRUIT GATHERER.— Andrew B. Anderson, Savannah, Ga. Combined with a receptacle and fruit cutting off device having operating arms, pivoted to a pole, is a chute by which the fruit may be conducted down in a convenient and expeditious manner, its fall being so checked or broken by means of draw strings that the fruit will not be injured. The mouth may be so formed that any one of a cluster of fruit, as apples, oranges, etc., may be removed from a branch without injury to or detaching the remaining fruit.

Miscellaneous.

DOOR CHECK. — David Rankin, Rosamond, Cal. A pivoted arm provided with a beveled catch is furnished with a chamber in its free end for receiving an elastic buffer, and a socket is fitted to the door for receiving the end of the pivoted arm, there being a plate for closing the socket when it is desired to use the device merely as a buffer. The device affords a simple means for arresting the motion of a door when thrown open, and for holding the door open.

SCHOOL FURNITURE.—Wilberforce A. Ramsey, Johnson City, Tenn. This invention provides an improved form of school seats, by means of which each chair can be adjusted to suit an adult or the smallest scholar. The back of the seat is held firmly in position, but the seat portion can be readily turned up out of the way, for sweeping, dusting, etc., there being a spring-actuated device for securing the seat in any desired position.

DRESS CHART.—John W. Stevenson, Ravenna, Ohio. This invention provides an improved garment chart by means of which patterns may be draughted directly upon the cloth or other material. Instead of consisting of a number of parts, to be adjusted according to the measurements of the garment, as heretofore, this chart consists of a single piece, dispensing with adjustments requiring time and labor. With this chart, and following the rules provided therewith, it is designed that any pattern may be draughted after measurements of the body, and a correct garment obtained.

CLOCK MECHANISM. — Grant W. Shuman, Lake Station, Ind. Combined with the clock work and a striking mechanism, is a series of bells mounted to travel and actuated from the clock work to come successively in the path of the striker. The arrangement is such that the striker strikes another bell at each stroke, so that the sound continues its full length without being interrupted and deadened by a second striking of the striker, as is the case usually, when only one bell is used.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

SCIENTIFIC AMERICAN
BUILDING EDITION.

JUNE NUMBER.—(No. 68.)

TABLE OF CONTENTS.

1. Plate in colors of a handsome residence on Riverside Park, New York City. Floor plans and elevations. Architect Mr. Frank Freeman.
2. Colored plate illustrating a row of brick dwellings at Newark, N. J., costing about $3,000 each. Perspective elevation, floor plans, etc. E. S. Amerman, Newark, N. J., architect.
3. Engravings and floor plans of a double residence on Washington Heights, New York City. Cost $20,000 each. A very picturesque design.
4. A dwelling at New Haven, Conn. Cost $8,000 complete. Perspective view, floor plans, etc.
5. A colonial cottage erected for Mr. C. W. Macfarlane at Elm Station, Pa. Cost $5,300 complete. Floor plans and perspective view.
6. Design of a modern interior. A comfortable hall and staircase.
7. A picturesque cottage erected for George W. Childs, Esq., in his Villa Park at Wayne, Pa. Cost $7,200 complete. F. H. & W. L. Price, Philadelphia, architects. Plans and perspective.
8. A tower house recently erected at Elm Station, Pa. Cost $4,600 complete. Floor plans, perspective elevation, etc.
9. A row of low cost colonial houses erected at Roseville, N. J. Cost complete $2,000 a house. Plans and perspective view.
10. An English cottage erected at Elm Station, Pa. Cost about $4,000. Perspective and floor plans.
11. Sketch of a farm house recently built in Steuben County, New York, at a cost of $695.
12. Miscellaneous contents: Simplicity in furnishing and decoration.—Weight as a test of strength in timber.—Architect of the Woman's Building of the Columbian Exposition, Chicago.—Redwood for interiors.—The Richmond heater, illustrated.—Some new designs in radiators, illustrated.—Improved plumbing appliances, illustrated.—Bent glass.—Improved woodworking machinery, illustrated.—A strong and light lawn fence, illustrated.—The "Heatencook" range, illustrated.—The H. W. Johns liquid paints.—A new roofing metal, illustrated.

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Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Barrel, Keg and Hogshead Machinery. See adv., p. 410.

For best hoisting engine. J. S. Mundy, Newark, N. J.

Wanted—Tin cans and steel shafting. Box 146, Maquoketa, Iowa.

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For Sale Outright—Patent No. 450,489, improved trolley guide for retaining trolley on wire. Apply W. E. Jackson, Jr., P. O. box 635, Augusta, Ga.

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The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(3119) N. W. N.—Brown's recipe for making transparent soap is as follows: 100 pounds dry bar soap to be heated and melted. Then pour in 25 pounds or more of melted sal soda. Agitate together at a low heat. Then add 100 to 125 pounds of glycerine, agitate, keeping up a moderate heat. Let settle. Draw off into moulds or soap frames. When cold cut into bars and cakes.

(3120) H. B. asks: What can I use to clear shellac stiffening from fabrics of a fur or shoddy nature without injury to the goods? A. Alcohol or borax solution.

(3121) T. M. P., England, asks: Will you kindly tell through the medium of your columns: The best mixtures of iron, and also the proportions of each kind, for making plow shares? The best method of chilling the same. A reviver for kid boots which will not crack or make the leather hard. A. You require a moderately hard iron. American Nos. 2 and 3 equal parts, or No. 2 and scrap to make a moderately hard casting that will polish by use. Chilling is only used for the point, which is cast in an iron mould, or more usually, an iron chill plate for the bottom of the toe. When kid boots need reviving we buy new. For dressing use French fluid polish.

(3122) R. W. R. asks (1) what is the meaning of the term "ohms resistance"? A. The ohm is the standard of resistance. A copper wire No. 16, B and S gauge, 243¼ feet long, has a resistance of one ohm. 2. Why are letters patent so called? A. This means an open writing. A paper by which power is given to a person to do some act or enjoy some right. 3. I have a room 20 by 80 feet, in which I burn 15 natural gas jets day and night, and I have often noticed that when the temperature outside is apparently the same at day and night that the room is much warmer at night than during the day. Why is it? A. Possibly the doors of the room are opened with less frequency at night than during the day. Have you applied actual measurement with a thermometer?

(3123) W. H. S.—Electric motors are reversed by changing the direction of the current in either the field magnet or armature, but not in both.

(3124) A. H. F. writes: I should like to suggest to the readers of the SCIENTIFIC AMERICAN who have constructed the simple electro-motor therein described, that the efficiency of the motor may be greatly increased by filling up the interstices between coils of armature with soft iron wires, cut in lengths equal to width of core, and bound in position by a thin wire or thread, around the circumference of entire armature.

(3125) F. H. F. writes: Please give me the weight of the heaviest locomotive engine now being used on any railroad in the world. A. About 70 tons for locomotive alone or over 100 tons for locomotive and tender loaded.

(3126) W. R. J.—The way to recover silver from a solution is to precipitate with hydrochloric acid, and add zinc and sulphuric acid, until all the precipitate of silver chloride is reduced to the metallic state. This will take some hours. Filter and wash with boiling water. The lead plates in Faure's storage battery are about one-sixteenth of an inch thick.

(3127) F. A. R. writes: I have a twenty-five horse power boiler with a working pressure of 70 pounds of steam from which I have been trying to get steam enough to boil linseed oil in a kettle containing a coil of 1 inch pipe, using an open exhaust. I have been able to get 250° of heat but no more. Will you be kind enough to tell me what is wrong? People who pretend to know say that a pressure of 300 pounds or more with a return exhaust will be necessary. The kettle is three feet high by four feet wide, and is about forty feet from the boiler. A. Linseed oil boils at 597° Fah. To boil it by means of a steam coil as you propose would require a pressure of more than one thousand pounds pressure in the boiler per square inch. Direct fire under the kettle is the usual way. Steam at 300 pounds gauge pressure has a temperature of about 420° Fah. This may accomplish what you wish in evaporating the volatile properties of linseed oil, but it will not boil it.

(3128) H. S. R. asks: Is color made by light or shown by light? Please explain in full as possible. Is white a color in any instances? In case of white ink, is it a color or is it colorless? Also, if you put colors in a row and take away the light, won't the colors remain? Does light simply show colors, or does it manufacture or make colors? A. Color is caused by light. Different surfaces possess different absorbing and reflecting powers and thus produce color by partial transmisson or reflection. White is the reflection of all colors of the visible spectrum. There is no color in a dark room. White ink is theoretically of all colors mixed. Black is theoretically the absence of all colors. Colors are in one sense present in light.

(3129) A. T. asks: Please inform me the way to oxidize sheet brass. A. For oxidizing brass, dip in a solution of 5 drachms perchloride of iron to 1 pint of water.

NEW BOOKS AND PUBLICATIONS.

A SHORT COURSE OF EXPERIMENTS IN PHYSICAL MEASUREMENT. By Harold Whiting. In four parts. Part III. Principles and methods. Cambridge: John Wilson & Son. 1891.

The restricted scope of the present volume of this valuable series makes it less amenable to review than its predecessors. It derives special value from its tables, which include much data that is ordinarily very hard to be found. Such are the tables of the properties of solids and liquids. For these alone the book is worthy of recommendation, independent of its relation to and place in its series.

POPULAR LECTURES AND ADDRESSES. By Sir William Thomson. In three volumes. Vol. III. Navigational affairs. London and New York: Macmillan & Co. 1891. Pp. x, 511. Price $2.

Navigation, the tides, terrestrial magnetism, and the mariner's compass, deep sea sounding, lighthouse characteristics, the laying and lifting of deep sea cables and ship waves are the topics of the present volume. It is needless to say that the subjects are admirably treated. Sir William Thompson has the art of giving a most graphic turn to his lectures, and engages the attention perfectly without resorting to the colloquialisms and extemporized words, whose use disfigures the text of the writings of so many of his contemporary scientists. Thomson rises above all these too prevalent traits, and in this volume of lectures, with addenda and supplements, presents a work of the greatest interest to every reader of scientific bias.

LA PLUME DES OISEAUX: HISTOIRE NATURELLE ET INDUSTRIE. Lacroix-Dauliard. Paris: J. B. Bailliere et Fils. 1891. Pp. 368. Illustrated.

This little work treats of birds useful or celebrated for their plumage. Numerous illustrations accompany the text. In addition to the natural history of the birds, the methods of using their feathers for fans, decoration, etc., is given in considerable detail.

EXAMEN QUIMICO Y BACTERIOLOGICO DE LAS AGUAS POTABILES. Par A. E. Salazar y C. Newman, y Dr. Rafael Blanchard. London: Burns & Oates. 1891. Pp. xix, 513.

This work, in quality of printing, paper, and numerous engravings, leaves nothing to be desired. The titular subject is fully treated and the bacteriology of water receives particular attention. A number of reproductions of microscopic slides are given to specially elucidate this part of the work.

METAL TRADES DIRECTORY FOR NEW ENGLAND AND NEW YORK STATE. Published by Price, Lee & Co. New Haven, Conn. Price $4.

This is a classified list of hardware manufacturers and dealers, machinists, engine builders, boiler makers, iron and brass founders, plumbers, stove manufacturers, gas fitters, etc. This directory is divided by States, and each trade is put under a separate head. There is also a complete index with references to the various manufactures in the different States. The classification is satisfactorily carried out and the lists seem to be complete and up to date. The volume contains about 1,200 pages. Each State contains an alphabetical list of names and also a classified directory of the trades.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

June 23, 1891,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Acid, amido-naphthol-monosulphonic, L. Gans... 454,645
Adding machine, D. I. Craig... 454,715
Advertising device, W. E. Robe rts... 454,769
Air compressor, E. Hill... 454,590
Animal stock, W. Stemen... 454,501
Animal trap, E. L. McClain... 454,657
Atomizer, A. H. Brown... 454,709
Automaton, walking, G. R. Moore... 454,570
Axle lubricator, car, L. J. Phelps... 454,763
Axles, process of and apparatus for making, W. J. Parmelee... 454,685
Baling press, C. Peterson... 454,495
B nd cutter and feeder, L. Sweet... 454,505
Banjo tail piece, H. Fenton... 454,728
Bank, automatic registering, Cooley & Balzer... 454,556
Bar. See Chain bar.
Bars by electricity, method of and apparatus for heating, E. E. Angell... 454,698
Barrel forming and hooping machine, J. Pleukharp... 454,764
Barrel hooping machine, L. D. Morrison... 454,803
Barrel hooping machinery, L. Hunter... 454,800
Barrel rack or truck, J. H. Barley... 454,448
Barrel tapping device, W. Lindenmann... 454,749
Baths, hygienic seat for, M. Alter... 454,510
Battery. See Galvanic battery.
Bed and dressing case, folding, J. Speed... 454,833
Bedclothes and baby holder, combined, C. Kanzler... 454,479
Bedclothes fastener, C. E. Angell... 454,695
Bedpan, Kynett & Van Dusen... 454,826
Bicycle, F. H. S. Moynahan... 454,583
Blackboard, etc., W. N. Cuthbert... 454,597
Blacking machine, R. Nagle... 454,755
Blower, grate, J. D. Foster... 454,468
Board. See Cutting and drawing board. Dash board. Press board.
Boiler. See Steam boiler.
Boiler setting, steam, S. Runser... 454,771
Boilers, constructing the flues of Galloway, W. Sellers... 454,571
Boilers, feed apparatus for heating, J. R. Hanlon 454,733
Bolster, extension, Roberts & Pullen... 454,620
Bolt operating mechanism for safe doors, E. & H. C. Stockwell... 454,595
Boring and turning mill, W. Lewis... 454,801
Boring cutter, L. S. Wright... 454,585
Boring machine, Kopacek & Vutech... 454,654
Bottle stopper, D. C. Guiltinan... 454,731
Bottle stoppering device, Elb & Moser... 454,463
Box. See Letter box. Match box. Paper box.
Brace. See Furniture brace.
Bracket. See Shade roller bracket.
Brake. See Car baake. Vehicle brake. Wagon brake.
Broom, P. C. Newbaker... 454,757
Broom, L. C. Richardson... 454,792
Broom or brush, steel wire, S. H. Brand... 454,607
Brush, Guffin & Petrie... 454,521
Brush or swab for liquid blacking, G. S. Wolff... 454,694
Brush, rotary tooth, N. B. De Galantha... 454,644
Buckle, E. J. Neuville... 454,756
Burner. See Gas burner. Hydrocarbon burner.
Burnishing machine, C. Keck... 454,480
Cabinet, show, Sherlock & Freeman... 454,755
Calipers, J. H. Dyson... 454,569
Can. See Filling can. Sheet metal can.
Candy for shipment, packing rock, N. Palmer... 454,619
Canning device, steam, C. F. Mudge... 454,523
Car brake, F. C. Brewster... 454,452
Car brake mechanism, street, N. C. Bassett... 454,450
Car coupling, W. Bentley... 454,704
Car coupling, C. M. Carnahan... 454,711
Car coupling, W. & S. L. Christian... 454,534
Car coupling, E. P. Eastwick, Jr... 454,721 to 454,723
Car coupling, J. W. Wagner... 454,550
Car couplings, carrying iron for, T. L. McKeen... 454,754
Car house hanger, C. A. Lieb... 454,487
Car, ore, J. V. Ericson... 454,577
Car, railway life stock, J. E. Hughes... 454,822
Car trolley, electric, W. Duncan... 454,536
Cars, sanding apparatus for street, L. Lakin... 454,683
Cars, trolley for railway, E. Verstraete... 454,532
Cards, machine for cutting the edges of, C. A. Wright... 454,554
Carrier. See Trace carrier.
Cart, road, F. J. Salmon... 454,687
Cartridge loader, G. B. Jacobs... 454,578
Caster, furniture, R. G. Jordan... 454,742
Casters, door knobs, and other articles, fastening for, J. Thinnes (r)... 11,171
Chain bar, ornamental, L. Towne... 454,629
Chair. See Railway chair.
Channeling machine, F. O. Wellington... 454,631
Chart for teaching addition, A. L. Gillis... 454,729
Chimney flue draught, hot air, V. Oster... 454,492
Churn, O. Linebarger... 454,750
Churn, vibrating, L. A. Miller... 454,752
Cigar holder, W. J. Stratton... 444,683
Cigarette machine, Ludington & Pollard... 454,593
Clay grinding machine, dry, J. Thompson... 454,780
Cloth pressing machine, H. W. Honeyman... 454,798
Clutch, electro-magnetic, Bennett & Parshall... 454,832
Coat, E. Robinson... 454,770
Coat and umbrella rack, combined, C. G. Udell... 454,507
Coin distributer, H. Kirkmeyer... 454,653
Commutators for dynamos or motors, C. A. Lieb. 454,488
Composition of matter, G. W. Melville... 454,489
Corkscrew, H. J. Ennis... 454,725
Corn or cotton stalk cutter, M. B. Banowetz... 454,617
Corset, W. W. Gould... 454,469
Coupling. See Car coupling. Hose coupling. Pipe coupling.
Coupling sleeve, J. G. Hallas... 454,648
Crozing and chamfering machine, J. Pleukharp... 454,765
Cultivator, S. H. Perry... 454,602
Curtain fixture, P. McCarthy... 454,491
Cutter. See Band cutter. Boring cutter. Corn or cotton stalk cutter. Feed cutter. Meat cutter. Veterinary incisor cutter.
Cutting and draining board, H. T. Wheeler... 454,552
Dash board, E. Walter... 454,783
Dehorner, T. A. Crowell... 454,563
Dental engine, G. W. Nutz... 454,659
Die, C. H. Langill... 454,830
Die cutting machine, C. L. Redfield... 454,567
Distilling apparatus, W. P. Swartz... 454,778
Door panels, machine for forming and polishing, Greenlee & Strom... 454,730
Draught equalizer, A. W. Hatfield *et al.*... 454,734
Drawers, R. E. Hill... 454,736
Dusting engine, J. D. Pickles... 454,525
Dye, gray, A. Cobenzl... 454,535
Dynamos, belt controller for, W. A. Foote... 454,467
Earth boring machine, E. Walton... 454,605
Electric circuit closer, J. H. R. Ward... 454,816
Electric conductor, A. W. Sperry... 454,546
Electric connection, J. H. Bickford... 454,794
Electric elevator, R. Eickemeyer... 454,462
Electric light hanger, G. W. Smith... 454,815
Electric lights and power, regulating, I. & A. Herzberg... 454,650
Electric lighting, system of, N. Tesla... 454,622
Electric machines, speed regulator for dynamo, E. E. Winkley... 454,541
Electric motor, F. B. Rae... 454,626
Electric motor, A. B. Roney... 454,627
Electric regulator for constant potential, C. Herling... 454,475, 454,476
Electric search light, G. Sautter... 454,604
Electric signal receiving instrument, Foote & Moore... 454,643
Electric system, overhead, C. A. Lieb... 454,486
Electrode, secondary battery, B. Anderson... 454,818
Elevator. See Electric elevator.
Elevator, J. R. Hopper... 454,591
Elevator and conveyer, C. H. Phillips... 454,663
Embossed and printed decorative materials for walls, etc., means for making, E. S. Sears... 454,667
Embroidering machine, H. Hochreutener... 454,737
Engine. See Dental engine. Dusting engine. Rotary engine.
Engine connection, steam, A. E. Parsons... 454,814
Engraving machine, Schraubstadter, Jr., & Schilling... 454,774
Feed cutter and crusher, E. A. Porter... 454,790
Feed water heater, W. J. Thompson... 454,781
Fence, S. H. Braden... 454,677
Fence, E. Manlove... 454,600
Fence post, W. H. Thomson... 454,506
Fence post, metal, J. J. Crane... 454,611
Fencing machine, automatic, W. P. Shattuck... 454,530
Fermenting vat, U. Bachmann... 454,586
File, paper, C. E. Stone... 454,502
Filling can, M. H. Garland... 454,614
Filter, C. G. Purdy... 454,766
Filtering apparatus, J. E. Warren... 454,817
Fire alarm, electrical, B. W. Leonard... 454,746
Firearm, magazine, W. Mason... 454,582
Fish hook, A. G. Mack... 454,580, 454,581
Floor jack, G. Bowler... 454,635
Frame. See Harrow frame. Quilting frame. Sewing machine frame.
Furnace. See Hot air furnace.
Furniture, book supporting attachment for, N. H. Whitten... 454,553
Furniture brace or stay, J. Berkey... 454,705
Gauge. See Micrometer gauge. Wall paper trimming gauge.
Galvanic battery, J. Emmer, Jr... 454,724
Galvanic battery, P. Hathaway... 454,598
Game apparatus, S. R. Clarke... 454,596
Game attachment, E. Barker... 454,700
Garments, suspension frame for, B. F. Lamb... 454,579
Gas, apparatus for the manufacture of, C. Stillwell... 454,531
Gas burner, J. M. Farmer... 454,640
Gas regulator or governor, L. Boore... 454,706
Gas retort, F. Bredel... 454,514
Gate, J. W. Miller... 454,802
Generator. See Steam or hot water generator.
Gold and silver from ores, apparatus for extracting, Howe & Gates... 454,538
Governor, steam engine, F. H. Ball... 454,511
Grate, J. Evans... 454,464
Grate for burning hard coal slack, S. J. Miles... 454,490
Grease trap for sinks, J. & J. F. Prendergast... 454,665
Guard. See Keyhole guard.
Hame, C. E. Johnson... 454,682
Hammer, power, W. Jones... 454,824
Hanger. See Car house hanger. Electric light hanger.
Harness pad cap, E. L. McClain... 454,656
Harrow, C. J. Kirk... 454,825
Harrow frame, Henry & Taylor... 454,474
Hat brims, machine for trimming the curled edges of, J. Fitz *et al.*... 454,565
Hat pin, lady's, L. Barnes... 454,702
Hearth, adjustable, J. H. Bennett... 454,703
Heater. See Feed water heater.
Heating and cooking apparatus, portable safety, J. House... 454,537
Heel nailing machine, W. J. Fahnley... 454,726
Holder. See Bedclothes and baby holder. Cigar holder. Rope holder. Shade holder. Shaft holder.
Hook. See Fish hook.
Hose coupling, J. G. Hallas... 454,649
Hose coupling, electric, J. B. Strauss... 454,669
Hose couplings, manufacture of, J. G. Hallas... 454,647
Hot air furnace, M. Koehler... 454,482
House. See Toy fire engine house.
Hub, wheel, G. H. Smith... 454,688
Hydrocarbon burner, A. C. Banning... 454,676
Hydrocarbons, solidifying liquid, J. H. W. Stringfellow... 454,777
Indicator. See Station indicator.
Insect catcher, H. C. Dexter... 454,720
Insulating material, A. W. Sperry... 454,547
Insulator for marine condensers, P. Decker... 454,717
Insulators, packings, etc., compound for the manufacture of, A. W. Sperry... 454,548
Iron. See Sad iron.
Ironing machine, W. Bullock... 454,456
Ironing machine, L. H. Watson... 454,786
Jack. See Floor jack.
Joint connection for metal framework, Westaway & Beard... 454,691
Key fastener, A. W. Bartholomew... 454,449
Keyhole guard, L. Gaddis... 454,789
Knitting fabrics, A. Boehmen... 454,795
Knob for carriages, etc., headed, C. O. & L. F. Upham... 454,549
Knurling tool, H. F. Cook... 454,788
Ladder, extension, W. E. Brown... 454,454
Lamp and burner, oil, C. M. Richmond... 454,686
Lamp, Argand, F. Rhind... 454,528
Lamp cut-out and system, E. Thomson... 454,782
Lamp, electric arc, Lemp & Wightman... 454,485
Lamp, incandescent electric, T. A. Edison... 454,558
Lamp, pocket, W. F. Folmer... 454,642
Letter box, L. Hammel... 454,732
Level for stair builders, plumb, F. Barnes... 454,701
Light. See Electric search light.
Lightning arrester, E. Thomson... 454,671 to 454,673
Limit switch, F. B. Rae... 454,496
Logs, apparatus for thawing, H. M. Crittenton... 454,716
Loom, Draper & Durkin... 454,564
Loom, J. H. Northrop... 454,805, 454,806, 454,808, 454,810
Loom, A. E. Rhoades... 454,791
Loom shuttle, G. O. Draper... 454,796
Loom shuttle, W. F. Draper... 454,797
Loom shuttle, J. H. Northrop... 454,807
Loom shuttle and spindle, J. H. Northrop... 454,809
Loom shuttle spindle, J. H. Northrop... 454,811
Looms, strap for connecting pickers with picker sticks of, C. E. Farr... 454,641
Lubricant, E. W. Cooke... 454,588
Lubricator. See Axle lubricator.
Marble roller, F. E. Phillips... 454,603
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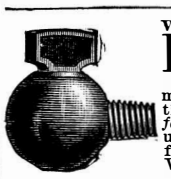

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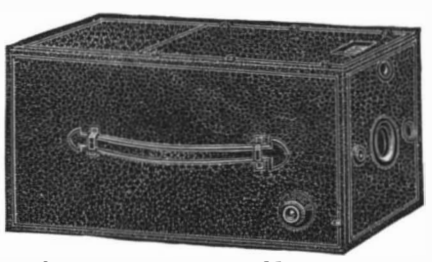

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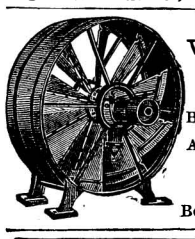

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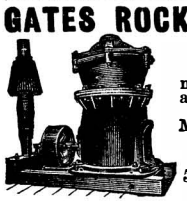

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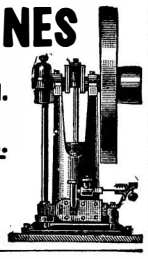

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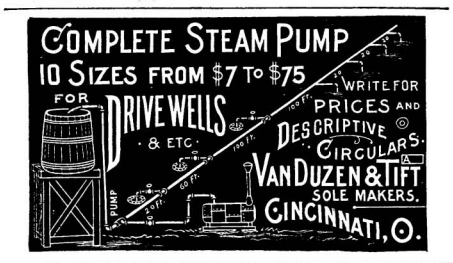
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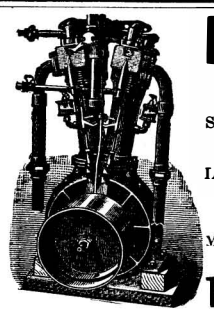

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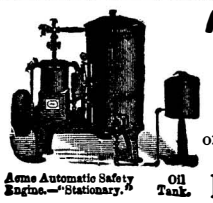

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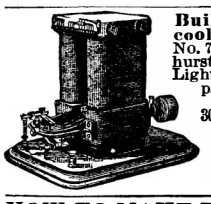

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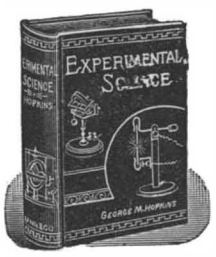

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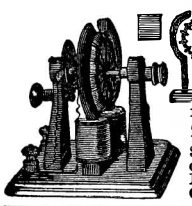

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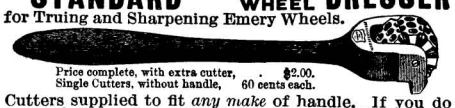

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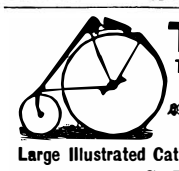

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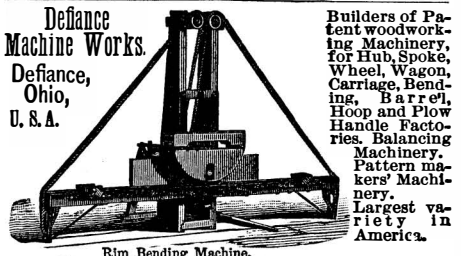

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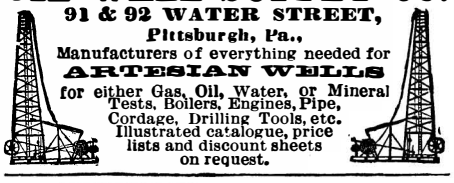

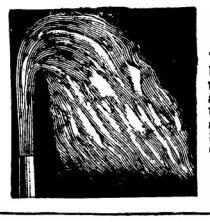

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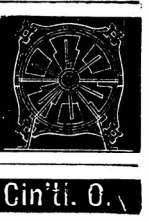

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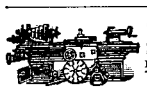

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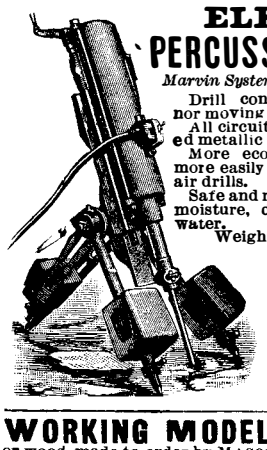

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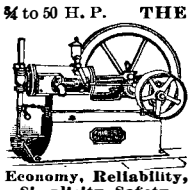

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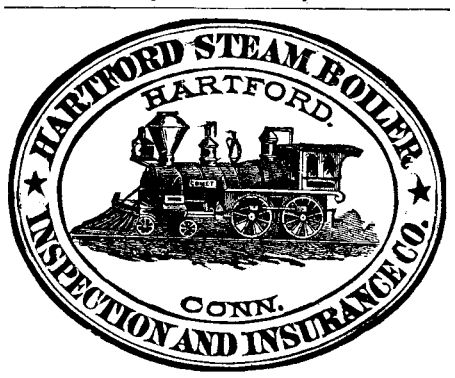

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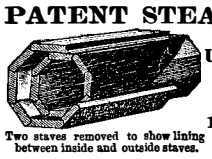

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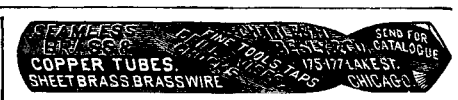

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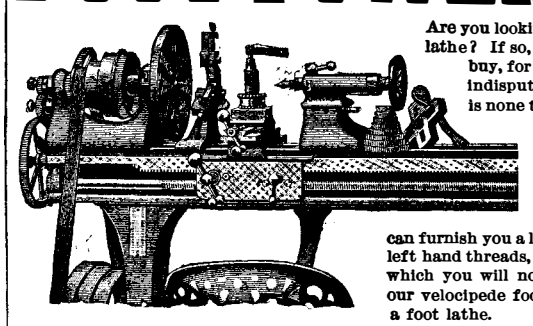

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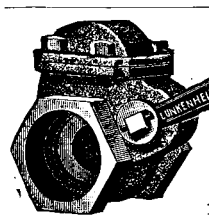

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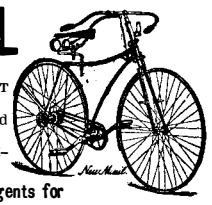

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